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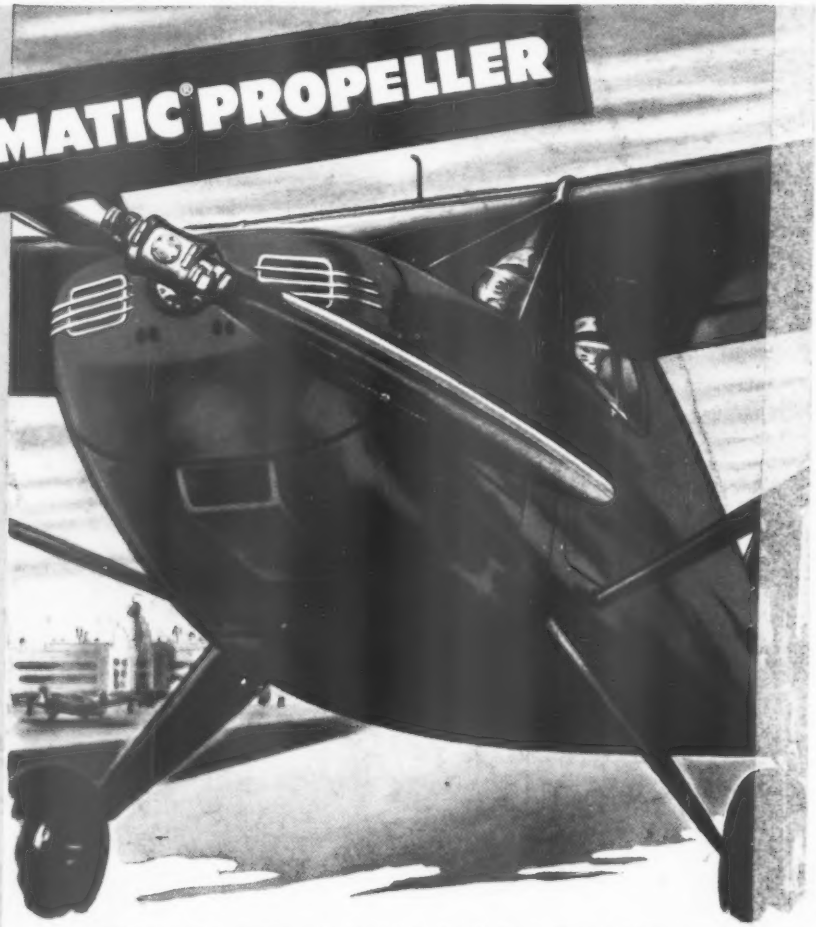

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For a description of Aeromatic's exceptional performance, see the illustration here—but for full facts, write today for your copy of the *free* Aeromatic booklet. Address: Koppers Co., Inc., Aeromatic Propeller Dept., 245 Scott Street, Baltimore 3, Md.

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The new landing gear equipment has other big advantages, too. It saves a *ton* of weight. It provides greater safety, greater economy, and it distributes the plane's weight over a greater area of runway, enabling the Constitution to use more airports.

Complete B. F. Goodrich assemblies—tire, tube, wheel and brake—are now available. And B. F. Goodrich can engineer an assembly to best meet the needs of *any* aircraft design, big or small. For help with your problems, write to *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

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THE COVER: North American Fury (FJ-1) is jet fighter designed for carrier operations.

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FLYING

MAY • 1949

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Flying Costs Less than Driving

On a recent round-trip business flight from the Midwest to the Pacific Coast, — some 4,000 miles in all — careful record was kept of all expenses. The figures showed that in this case, as in countless others, the cost of the journey was far lower than if it had been made by car. Actual money saving amounted to about one-third. When you add to this the time saved, and consider the greater comfort of flying, you begin to understand the increased use of personal and executive type planes. Have the Continental dealer at your airport tell you how easy it is to "Start Flying Now".

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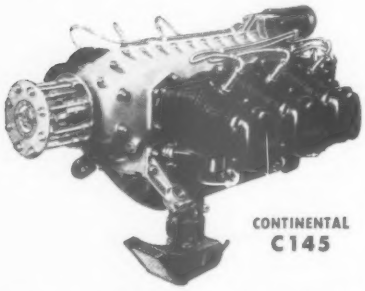
When you choose a Continental-powered plane, you get the backing of a service network as far-flung, and as competent, as the service organization behind your car. There are Continental service and parts at almost every airport in the free countries of the world.



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Here's the 6-cylinder 145 h.p. engine that is powering a number of 4-place personal and executive planes. The introduction of the C-145 was another phase of the long-range Continental Motors program of building the engines that meet the needs of the aircraft manufacturer — and user.

Continental Motors Corporation
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THE MAIL BOX

HOW FAST IS FAST?

You say in your December Jet issue that the X-1 and D-558-1 are exploring the transonic zone. The Bell X-2 and the Douglas D-558-2 will investigate the higher transonic speeds and get into supersonic speeds, along with the Northrop X-4. The Douglas X-3 will investigate the high subsonic speed ranges and get well into supersonic speeds. . .

Supersonic Northrop X-4.

When you get into transonic zone, higher transonic speeds, and high subsonic speed ranges, it's mumbo-jumbo to me. How about starting at the bottom, and saying which of these speeds is faster than which?

ARTHUR E. KEELER
Peekskill, N. Y.

● Generally speaking, there are three conditions of airflow — *subsonic*, when flow over the entire airplane is below the speed of sound; *transonic*, when local regions of subsonic flow exist along with local regions of supersonic flow; and *supersonic*, when all flow is above the speed of sound. Subsonic extends up to about Mach .85; transonic from about Mach .85 to Mach 1.15; and supersonic above Mach 1.15.—ED.

GEOGRAPHY

I was interested to read that Westchester Airport is now located in New Jersey instead of New York! ["How I Sell Planes," February FLYING] . . .

I. W. STEPHENSON IV
Atascadero, Calif.

● To a careless editor, a set of geography books. Westchester Airport is still doing business at the old stand, Armonk, N. Y.—ED.

SHERIDAN ON STALLS

. . . I can go along with Hy Sheridan on the idea that sudden change in wind on an approach might well be extremely serious ("A Lesson in Relativity," March FLYING). But I'd wager $50 that the plane would *not* stall; and the problem is just serious enough to require additional expert opinion.

JOHN W. HARVEY
Minnistee, Mich.

. . . Suppose an airplane is flying at 150 m.p.h. into a 5 m.p.h. headwind. The plane reverses course. It speeds up 10 m.p.h. with respect to the stars. The plane's speed with respect to the air mass it occupies remains at 150 m.p.h., because the speed of the air passing the plane (or more rightly, the speed of the plane passing the air) is dependent on the ratio of thrust to drag on the plane, not the speed of wind blowing past it. If wind blew past a plane instead of blowing a plane with it, a 100 m.p.h. tailwind would stall out a plane making 100 m.p.h. air speed. Any air flow PAST a plane is controlled by the *thrust* exceeding the *drag*, and that is controlled by the pilot independent of the speed of the air over the ground. . .

ROGER PATTERSON
Lieut. (jg) USNR
New York City

. . . Now I'm not an airline pilot or even a captain, but the dear young crop-duster from Loo-sanna who booted me through my basic in Liaison Pilot School gave us this to understand:

"Upwind, downwind, no difference except groundspeed! . . .

Air mass movement; you're always in one. But as long as your airspeed is above stalling speed, gusts will not stall you out. .

BARRY D. DOWNING
Second Lieutenant, Inf.
Cincinnati, Ohio

I disagree entirely. . .

GEORGE E. PARMENTER
Dennis, Mass.

. . . Hy's slips are hanging out like Wrong-Way Corrigan's ears. . . His flaps are dragging in this article. . .

WILLIAM J. (SULLY) O'SULLIVAN
RFD, Saluda, Va.

. . . I'm surprised this obvious point wasn't mentioned at some point in Ensign Ranney's Naval Aviation training. . .

LEO MACKTA
Brooklyn, N. Y.

. . . Thanks for the article. That's the kind of reading that makes flying safer. .

V. EPERSON
Walden, N. Y.

● FLYING quotes from the Sealand News, published by Ansonia Airport (Ansonia, Conn.) and Island Airport (Shelton, Conn.): "[Sheridan's] article simply defines and explains the same problem the CAA at Westfield submitted for our contest last year. The figures have been changed slightly and the thing is given a new twist but it is essentially the same

(*Continued on page 74*)

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If you were at *Northrop* preparing for a career in Aeronautical Engineering you could step out of your classroom and study this "buzz bomb." It would bring to life your classroom topics and textbook knowledge . . . for this unusual aircraft illustrates principles of aerodynamics, advanced aeronautical design, and methods of flight control for all-wing, jet-powered aircraft. Studying it changes dry theory to practical knowledge in short order.

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Check one: ☐ Veteran ☐ Non-Veteran

NOTES ON CIVIL FLYING

. . . **Over 134 Convair-Liners** have been delivered to domestic and foreign airlines. In addition, two executive-type Convair-Liners have been delivered to individuals.

. . . **A new type oil tank** capable of withstanding fire and temperatures of 2,000° has been developed for the Navy by Goodrich. The flame resisting container, first of its kind, is also bullet sealing for Naval aviation uses. To dramatize heat resistance of the new oil tank, a blow torch with a four-inch flame was directed against it without damage.

. . . **University of Illinois** owns and operates a fleet of 33 planes for flight training courses.

. . . **Puerto Rico** has launched construction of a $12,000,000 international air terminal with 8,000-foot runways. The new Isla Verde airport will have facilities capable of handling 50 planes hourly. About 1,300 flights per month now clear through San Juan during peak seasonal traffic.

. . . **Piper Aircraft** Corporation is installing Safe Flight stall warning indicators on all Piper four-place aircraft. William T. Piper, president, explains: "Because of the variable loads which can be carried in our larger models, and the resultant wide range of stalling speeds, we have decided that the addition of stall instrumentation is a most desirable addition despite the excellent inherent stall features in our aircraft and their docile stall characteristics. The indicators are already standard on Piper's Stinson *Voyager* and *Station Wagon*, and will now go on the Piper *Family Cruiser* and new Piper *Clipper*.

. . . **Doman Pelican**, seven-passenger helicopter, will have the cab located over engine, giving advantage of easy maintenance and permitting location of payload astride craft's center of gravity.

With 245-h.p. Franklin engine, Pelican will have gross weight of 3,200 pounds and will carry useful load of 1,400 pounds, manufacturer claims. (See model, above.)

. . . **Midget racer** builders can obtain a booklet giving official 1949 specifications for 190-cubic-inch Goodyear Trophy race entrants from three groups: Contest Board, National Aeronautic Association, 1025 Connecticut Avenue, N.W., Washington, D. C.; Aviation Products Division, Goodyear Tire and Rubber Company, Akron, O.; Professional Race Pilots Association, Torrance Municipal Airport, Lomita, Calif.

. . . **National Air Races** will be held in Cleveland, September 3-5, 1949.

. . . **Airport officials** at Myrtle Beach, S. C., planted part of their airport with lespedeza hay, which grows to a height of about eight inches and therefore does not interfere with the use of the area by planes. They harvested 1,450 bales of hay, which sold for $30 per ton.

. . . **Flying Lawyers, Inc.**, has been organized as an Indiana corporation. Incorporators are Clare W. H. Bangs, former mayor of Huntington, Ind.; Lowell L. Pefley, judge of the Whitley Circuit Court, and Raymond Brooks, county attorney of Wabash county, Ind., Box 146, North Manchester, Ind., who can be contacted for information.

. . . **Five feederline franchises** expire this fall, and the Civil Aeronautics Board is reported to be unlikely to renew most of the experimental certificates. Feederline traffic has been disappointing to many observers, and West Coast Airways, the company with the highest load factor, averaged only 35.79 per cent in 1948. A number of airlines actually showed a smaller load factor in 1948 than in 1947. CAB has already refused to extend the certificate of Florida Airways beyond March 28. With the help of higher mail pay, a number of feederlines made a profit last year, however.

. . . **Crew error**, not structural or mechanical failure, caused the recent crash of the experimental Beechcraft Model 34 *Twin Quad*, near Wichita. Beech reports the crash occurred after a small fire developed in the electrical system on a routine flight. Crew members started to fight the fire, and during the excitement someone inadvertently operated the master emergency switch, cutting off all engines. This caused instant loss of power at such low altitude that recovery of power and selection of a proper landing field were both impossible. The co-pilot was killed in the crash, and the other three crew members were injured.

. . . **Trip-Eze**, the air sickness remedy, is now legalized for sale over the counter and is sold in over 400 airports and is being used by 30 commercial airlines and 15 steamship companies.

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Northern Air Service, Inc.
Grand Rapids Airport
Phones: 3-3625—3-3626

MISSOURI—KANSAS CITY
Toth Aircraft & Accessories Co.
Municipal Airport
Phone: NOrclay 3878 and 4752

—ST. LOUIS
St. Louis Flying Service
Kratz Airport—Phone: TErryhill 5-3130

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Southern Ohio Aviation Co.
Dayton Municipal Airport
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MOUNTAIN STATES

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Mountain States Aviation, Inc.
Stapleton Field—Phone: DExter 4205

MONTANA—BILLINGS
Gillis Flying Service
Municipal Airport—Box 1718
Phone: 2288

SOUTHWEST

OKLAHOMA—OKLAHOMA CITY
Page Aviation Service
Municipal Airport
P. O. Box 535—Phones: 6-4458 - 59

TEXAS—FORT WORTH
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Meacham Field
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ARIZONA—PHOENIX
Thunderbird Aviation Corp.
Sky Harbor Airport, 2416 East Buchanan
Phone: 4-7559

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Transport Corp.
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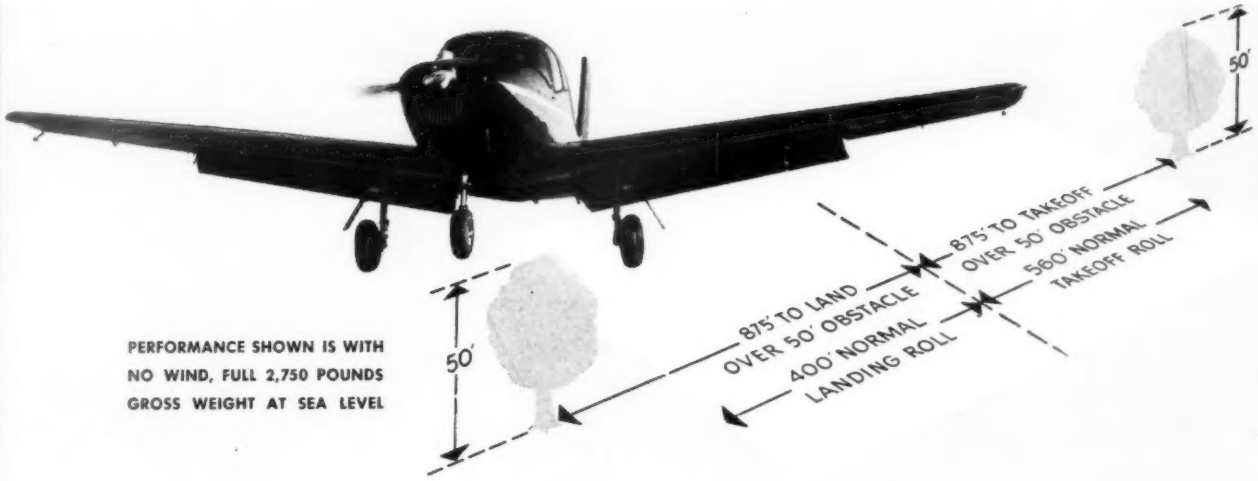
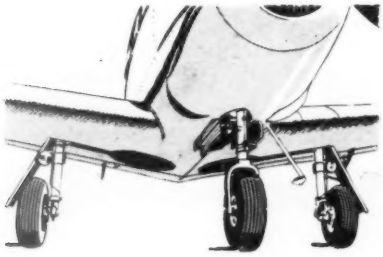
SPEAKING OF SHORT-FIELD PERFORMANCE!

THE '49 RYAN NAVION IS IN A CLASS BY ITSELF!

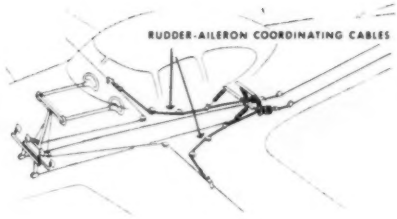


PERFORMANCE SHOWN IS WITH NO WIND, FULL 2,750 POUNDS GROSS WEIGHT AT SEA LEVEL

DON'T WORRY if that smooth, concrete runway is miles from where you want to go. A *Ryan Navion* will take you into short, rough strips... and out again, with ease and safety. Think of it! *Navion* lands at only 54 m.p.h. with full gross load. Its high-lift, full-deflection flaps lower 43° to make possible slow, steep approaches. Only 875 feet are needed to clear a 50-ft. obstacle—both on landing and take-off. *Navion's* husky 205 h.p. engine will give you 900-ft. of altitude in your *first minute* of flight! Performance like this is mighty important to the man who wants a rugged, versatile plane with plenty of utility that'll get him there and put him down right where he's needed. Yes, *Navion's* short-field performance is a big reason why it's the growing favorite among businessmen pilots.



WIDE WHEEL TREAD and high ground clearance...big, steerable balanced nosewheel and oversize tires enable you to set the *Navion* down smooth as velvet on rough, soft fields, even in cross winds. Big, equalized hydraulic brakes ease ground-handling. Deep-stroke hydraulic shocks are real heavyweights.



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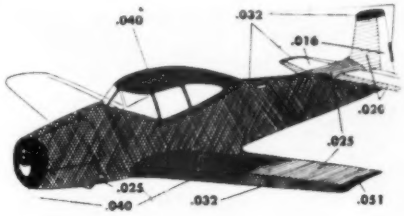

BIG AND RUGGED, the thick-skinned, all-metal *Navion* represents highest structural integrity in aircraft design. Low maintenance cost and permanent beauty are assured. Send now for colorful, FREE brochure which gives complete details on all 29 dramatic advancements in *Ryan Navion* for '49.

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Ryan Navion

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- Recessed Arm Rests
- Thicker Foam Rubber Cushion
- 4 Individual Side Ash Trays
- Easy-Entrance Roll Back Canopy
- Thicker Plexiglas Windshields
- VHF Radio
- Improved Control Panel
- More Instruments
- Dual Fuel System

Memo from

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Fleet operators

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MILITARY NEWS

. . . **Student flight surgeons** at the Air Force's School of Aviation Medicine, San Antonio, Tex., will be taught how to fly. A 10-week flight course will include approximately 65 hours of flying time.

. . . **Five B-29 groups** will train in England during the first half of 1949, with two or three groups in training there at all times. The U. S. Air Force medium bomber outfits will rotate between their home bases and British training bases at three-month intervals.

. . . **About 700 Air Force pilots** will serve as Air ROTC instructors at U. S. colleges and universities when the Air Force assumes complete jurisdiction over the courses on July 1.

. . . **Two top generals** in the Air Force recently exchanged commands. Lieut. Gen. George E. Stratemeyer, commanding general of the Continental Air Command, replaced Lieut. Gen. Ennis C. Whitehead as commanding general of Far East Air Forces in Tokyo. General Whitehead assumed command of CAC.

. . . **A new auto-pilot**, capable of flying large transports under unfavorable weather conditions and capable of a fully automatic letdown to a runway, has been developed by the Navy. Still in the experimental stage, the device (called the "angle of attack auto pilot") weighs 140 pounds.

. . . **A piloted supersonic rocket** has been developed by the Russians, according to Vokrug Sveta, a Soviet science magazine. The projectile is described as the spearhead of the new Soviet Air Force. The magazine added that the Reds also have an "Omega helicopter" capable of speeds up to 450 m.p.h.

. . . **A non-segregation policy** for personnel was recently proposed by the Air Force. Now before the Secretary of Defense, the policy is intended to end segregation of and discrimination against Negro flyers.

. . . **Safety record of planes** on the Berlin Air Lift is higher than that of the Air Force as a whole, according to a report by Col. Robert V. Garrett, chief pilot of the CAB. He points to three important factors contributing to the Air Lift safety standard: (1) carrying of a flight engineer, (2) adoption of standard instrument panel making all planes equally familiar to pilots, (3) staggering planes in flight so planes do not follow directly behind each other in lanes of operation.

. . . **Ninety passengers** flew coast-to-coast recently in a Navy four-engine *Constitution*. The record passenger load for a transcontinental flight was carried in the 92-ton Lockheed transport in 9 hr., 32 min.

. . . **North American F-86** (above), holder of the world's speed record of 670.981 m.p.h., has been officially named the *Sabre*.

. . . **Radiological defense tactics** are taught at a new Air Force school at Keesler Air Force Base, Biloxi, Miss. Students from the Air Force, Navy, Army, Coast Guard and U. S. Public Health Service receive a six-week course on how to deal with effects of atomic or radiological attacks.

. . . **First Cyclone 7 engine** for the North American T-28 was delivered recently by Wright Aeronautical Corporation. The 800-h.p. engine, smallest in the Cyclone series, is designated the R-1300 by the Air Force.

. . . **Fifty pilots** were recently assigned by the Air Force to duty as instructors for National Guard aircraft control and warning squadrons.

. . . **More British jets** will be built this year, with the RAF scheduled to double its jet fighter strength by mid-1950. The British are designing an "interim jet bomber" with speed approaching 500 m.p.h.

. . . **A robot device** that can send 60 messages simultaneously from a supersonic missile is being used by the Navy to obtain data on guided aerial weapons. The device has a radio-telemetering system which sends messages to two ground control stations, where they are recorded. It is in service at the Navy's ordnance test station, located at Inyokern, Calif.

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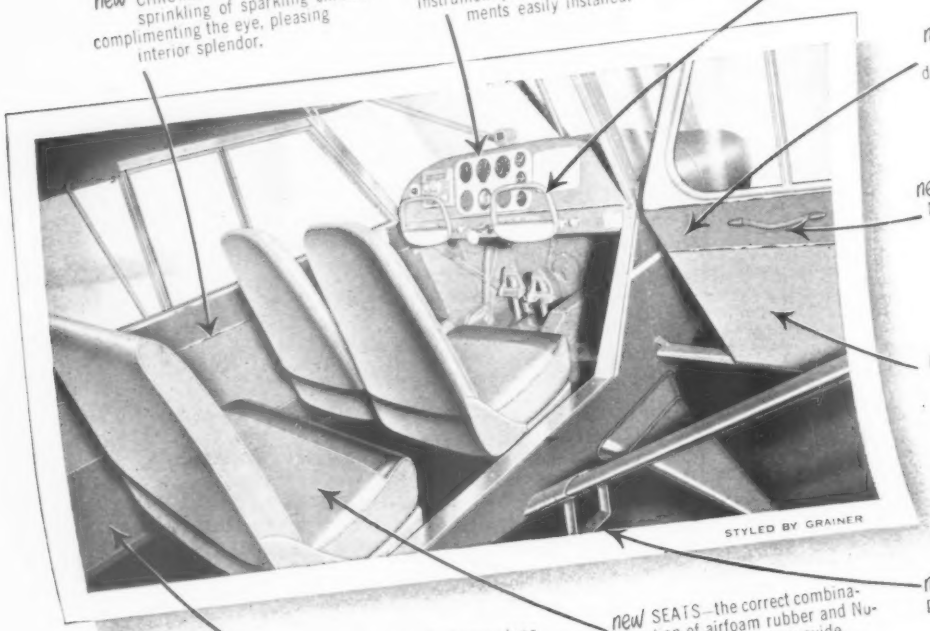

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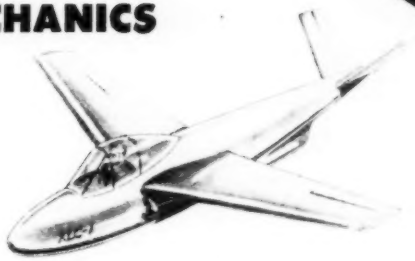

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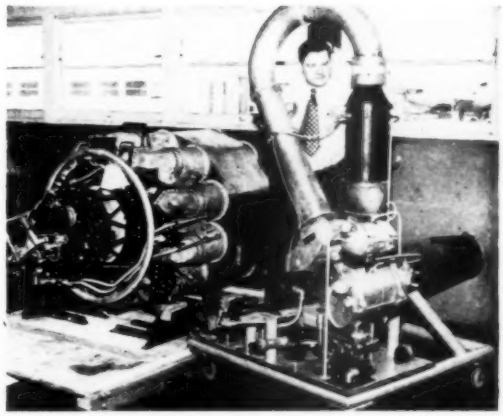

CAL-AERO STUDENTS ACTUALLY DESIGN ORIGINAL MIDGET JET PLANE — IN ADDITION THEY HAVE DEVELOPED AND ARE BUILDING ITS JET POWER PLANT

This is a forerunner of possible future jet powered personal planes. This single place jet airplane and 240-lb. thrust jet engine has been developed and is being built in Cal-Aero's Engineering School. The upper sketch shown is the design study of the plane—the photo shows its tiny jet engine alongside a "big brother", a GE J-33 turbo jet. This actual developmental project is only a part of our modern streamlined training program that prepares "Cal-Aero" graduates to step directly into the best paying jobs

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F-5

Young man's world

These four men caused a minor business revolution 20 years ago by new field-selling techniques in a nationwide business.

But the more the new company grew, the more these men-with-vision were bound to the home office. They were becoming mere legends to employees in the field. The business began to slow down.

But not for long. The company bought a twin-engine Beechcraft Executive Transport and put fleet 4-place Bonanzas in the field. Because these business planes can make a 75% reduction in business travel-time, adequate field work was once again possible. With new and complete mobility of action, management really started managing again.

Now their business is bigger than it ever was before, and there's even more time for rest and relaxation. They're youngsters again in a young man's world—and this is something the most fabulous salary could not purchase for them.

● A note on your company letterhead will bring an informative 60-page brochure on "The Air Fleet of American Business." Address Beech Aircraft Corporation, Wichita, Kansas, U. S. A.

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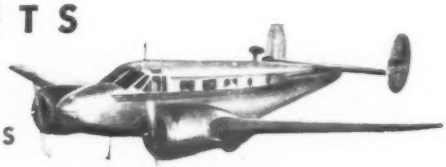
Bonanza Model A35



Executive Transport Model 18

The Government's ahead $50,000,000 in its dealings with air mail carriers.

Air Line Skies are Clearing

By CARLETON PUTNAM

Chairman of the Board, Chicago and Southern Air Lines

THE AIR transport industry, freighted with the public interest not only as regards the commerce of the United States but its social welfare and military defense as well, has passed through a cold front and is headed toward a high.

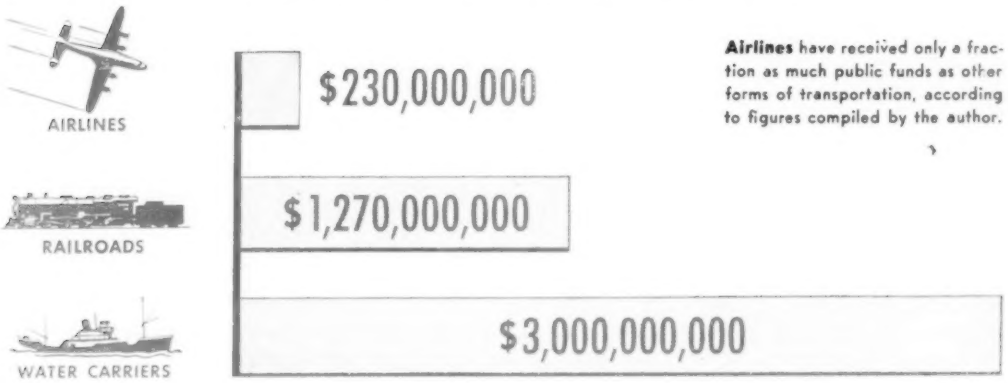
For three years the air lines have battled against the fogs of Congressional and public confusion, victims of every sort of economic heresy and misconception, blamed when they should have been praised, starved when they should have been nourished—and all because the sunlight of simple fact could not break through. Today the truth is gaining ground and the fogs are lifting.

There was never anything complex about it. No new form of transportation in the history of the planet has ever sprung to full maturity without Government aid, for reasons too obvious to need discussion. Two of these stand out like mountains. Transportation is a public service with many obligations beyond the scope of ordinary business, and new techniques of transportation require long development and a long suit for public acceptance. Indeed the taxpayer is lucky who receives as good a deal as the American taxpayer has gotten from the airlines.

Consider the facts. The airlines have had about 1/5 the help the railroads had, and 1/12 as much as the water-carriers, and while it is true the rails are a much larger industry today than air transport, *they were not more important a hundred years ago when they were in their corresponding stage of development and when they got the most help.*

Moreover, all the net burden on the taxpayer represented by the air mail subsidy to date has been earned back in postage revenue plus fifty millions besides. The taxpayer has gained cash from the deal, not to mention an auxiliary to the national defense that would have cost him untold millions to provide by other means. And all this has been accomplished in 20 years. It took the railroads a century and half to earn (*Continued on page 72*)

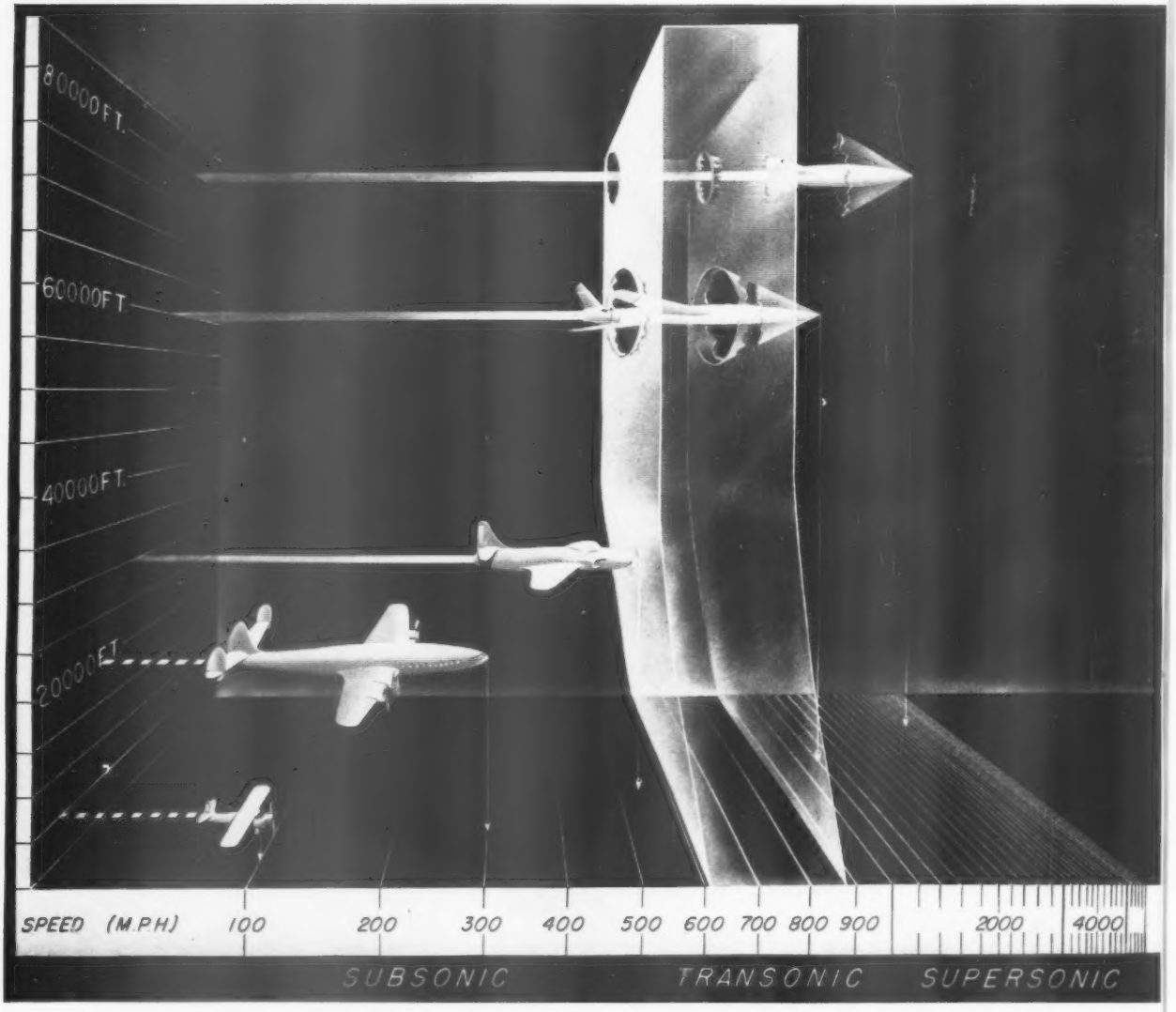
PUBLIC AIDS TO TRANSPORTATION



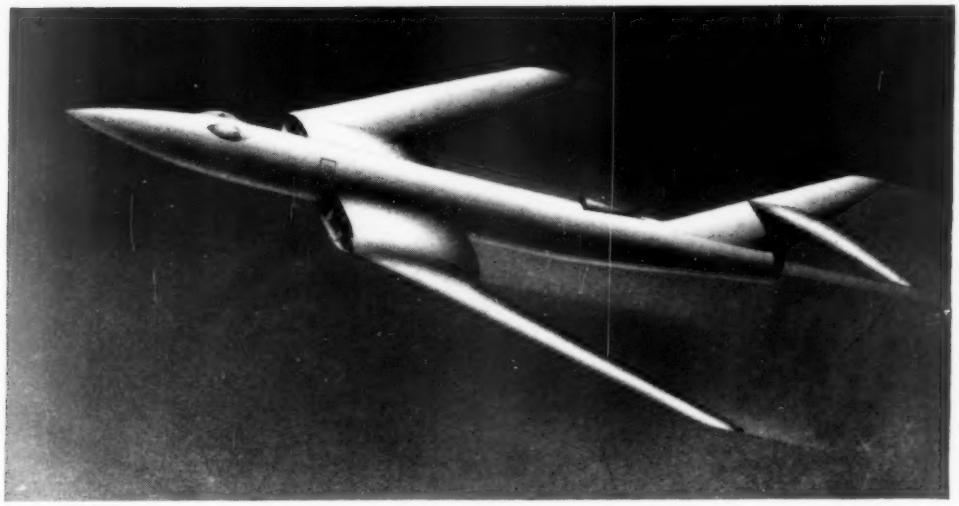
Airlines have received only a fraction as much public funds as other forms of transportation, according to figures compiled by the author.

KNOW YOUR SUPERSONICS

Transonic and supersonic regions are aviation's new frontiers. What happens when planes fly faster than sound?



Sonic "barrier" exists in transonic region, where flow over parts of plane is supersonic (accompanied by shock waves) while over other parts it is subsonic. Note that compressibility conditions occur before entire plane reaches sonic speed. Mach cone (formed beyond the speed of sound) slants back, becomes more pointed as speed increases. Power needed for supersonic flight increases as cube of speed.



Supersonic transport proposed by NACA is designed to keep plane's outline within the "safe" Mach cone.

By WILLIAM WINTER

ALWAYS QUICK with pat explanations of scientific problems, the public insisted for years that supersonic planes needed wings angled back like arrowheads. They combined this gospel with the theory that props could never drive a plane faster than sound, and settled back to expound their knowledge.

About that time, the Air Force built its straight-winged X-1 (intended to do 1,500 m.p.h.) and shoved it through the so-called sonic barrier.

Then the NACA announced that a theoretical prop could attain speeds of 840 to 1,500 m.p.h. They had adopted a triangular or delta-shaped wing to a prop. By bisecting the apex of the triangle with the shaft line, and by twisting each half of the wing (or blade) like a gigantic wood screw, they came up with a weird prop of 72-foot pitch and 12-foot diameter that could barrel along at 1,500 per.

The "insiders" felt like fellow travelers caught in a switch of the party line.

But even these seemingly revolutionary developments didn't relegate present supersonic concepts to the world-is-flat scrapbox. Actually, the public had been (and still is) on a binge concocted of half-truths and hasty assumptions.

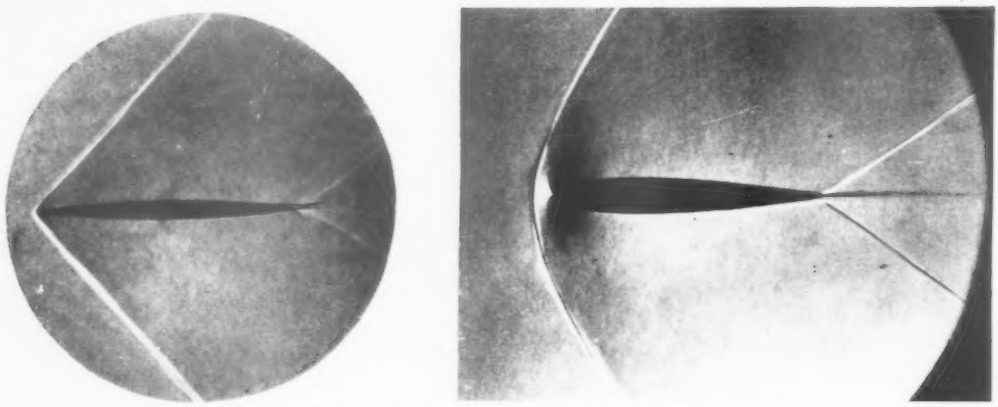
Like repetitious advertising, that glamorous term, "speed of sound," has been taken for granted. The rate of travel of sound, says the National Advisory Committee for Aeronautics, is the rate at which air can transmit sound waves. Sound waves are pressure waves. These pressure waves or disturbances travel at a certain rate because the air has a limit of elasticity, depending on its temperature.

Temperature, NACA says, governs molecular activity. The hotter the gas—and air is gas—the faster the molecules move and strike one another; the colder the air, the slower the molecules move. An increase in pressure, as caused by an airplane in flight, displaces molecules in the immediate vicinity and their motion is transmitted to other molecules, forming pressure waves that travel outward in all directions, much like the ripples caused by a stone thrown into a pool. At standard temperature of 59° both the speed of the pressure wave and the speed of sound is 760 m.p.h. On a scorching 100° day, the speed of sound rises to 800 m.p.h. In the 150° below laboratory chill, it falls off to a measly 588 m.p.h. The chief way that altitude affects the speed of sound is by change in temperature. Now the plot thickens.

Imagine an airplane standing still in the air. Then pressure waves, perhaps from the prop, would travel an equal distance in all directions in a given interval of time. But in flying, the airplane tends to overtake the waves spreading forward and to leave behind those spreading to the rear. In other words, the speed of the plane can be subtracted from the speed of the forward traveling waves and added to that of the rearward spreading waves. Obviously, when the speed of the plane equals the speed of the forward moving waves, and of sound, something must happen. But what?

Pressure waves travel outward as a series of concentric circles or, more accurately, as spheres. In one interval of time, the first wave is one radius from the source of vibration. In another interval of time it is two radii away, while a second wave has traveled one radius, and so on like a succession of rapidly expanding spheres. As the plane moves forward, these circles of wave propagation fall closer together in front of the plane and farther apart behind it. When the plane travels fast enough (but not faster) to catch up with these waves, they pile up in one continuous standing wave that keeps pace with the airplane. If the plane exceeds the speed of sound, going faster than its own pressure waves, this standing wave will be left behind. The crux of this business, the relationship of the plane's forward speed to the speed of sound, makes a definite angle at which the pressure waves will trail behind. This angle is called the Mach angle, and is an index of speed.

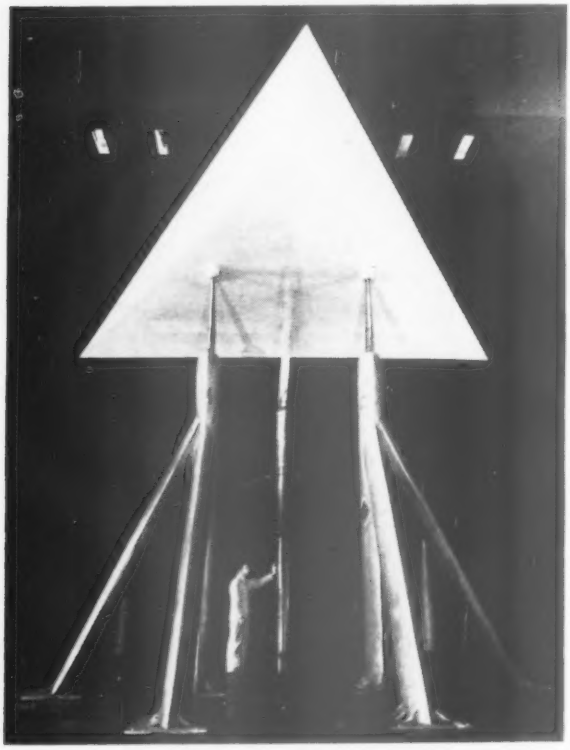
Visualized in its three dimensions, this Mach angle is really cone shaped. The greater the margin of speed above the speed of sound, the more slanted back, or pointed, this Mach cone becomes. All the hokus pokus about odd planforms, triangular wings, delta wings and paper dart airplanes results from having to keep the outlines of the supersonic machine within this Mach cone clear of the shock waves. A wing that protruded through this cone would create a larger shock cone, further increasing drag and power required. Wing span, aspect



Supersonic shock waves, forming on NACA airfoils, are shown in Schlieren photos. Wave attaches to sharp edge of supersonic wing (left), slants back cleanly. But on subsonic section (right) a bow-shaped, unattached turbulent wave forms.

ratio, wing location, even the needle-sharp nose of a fuselage, are determined by this Mach cone.

It is easier, and safer, to express a fast plane's speed as, say, Mach 0.8, which means 8/10ths the speed of sound, rather than as so many miles an hour. Airspeed does not reveal how close the plane may be to the speed of sound. If the speed of sound is 760 m.p.h., an airplane flying at a Mach number of 0.8 will have an airspeed of 608 m.p.h. But if the air is cooler and the speed of sound consequently reduced, say, to 660 m.p.h., the same plane, at the same Mach number, will be going only 528 m.p.h. This is why a plane can exceed the speed of sound at less than the school boy's textbook 720 m.p.h.



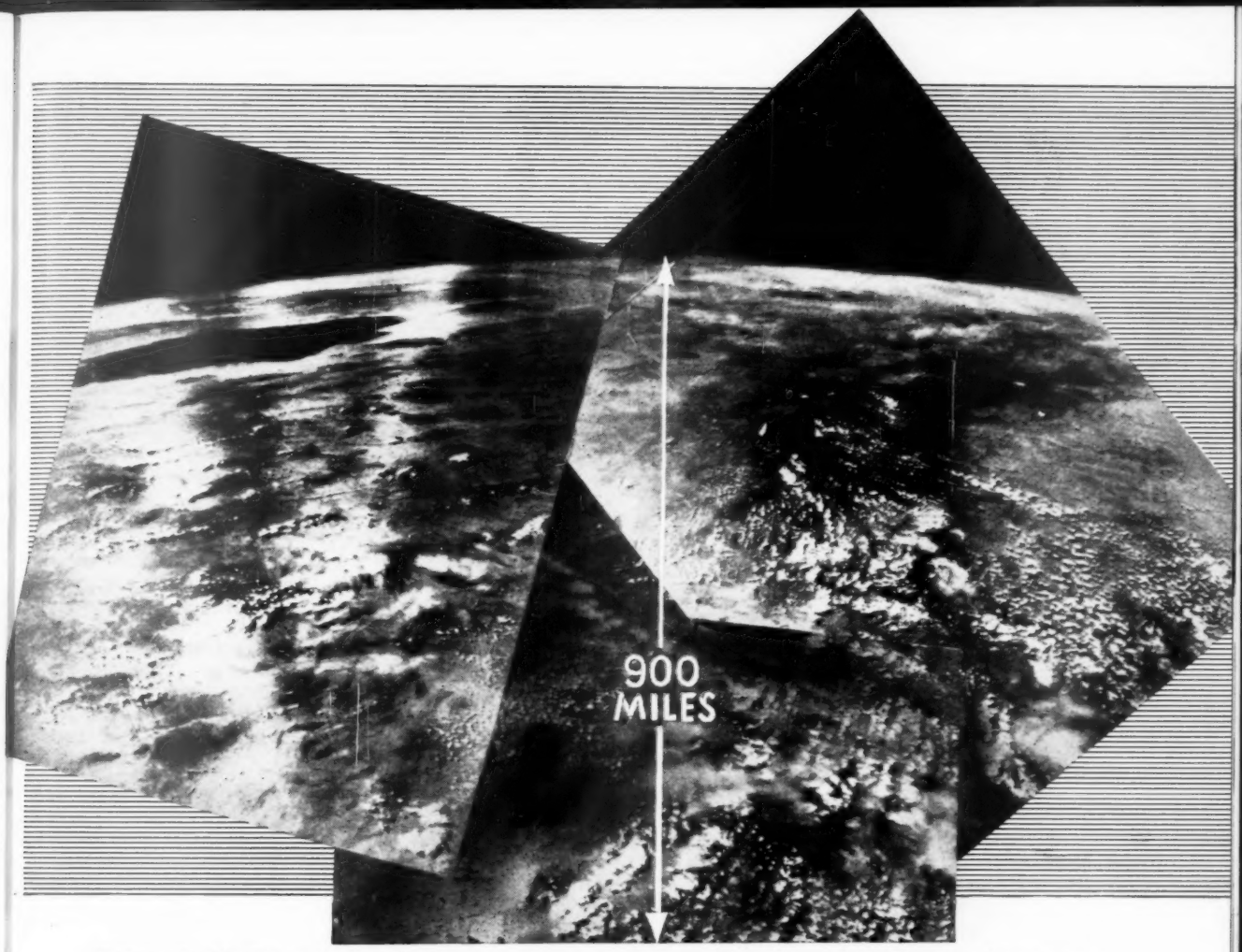
Delta wing, mounted in giant wind tunnel of Ames Aeronautical Laboratory, is new approach to design of supersonic airfoil.

Until comparatively recent times aerodynamics were based (and still are, below the speed of sound) on the convenient assumption that air can be treated like an incompressible liquid, flowing smoothly over the surfaces of the plane. Today, this is only half the story. Above the speed of sound, air *is* compressible by the airplane. What happens in the one case is that air will separate and flow around the airplane but, on the other, it slants off the plane in oblique shock waves. Below the speed of sound the pressure waves skirmish ahead, as it were, to warn the air ahead, which moves aside to permit the plane to slide through. But when the plane thunders along faster than its own shock waves it arrives unannounced, piling up the air ahead and forming those slanting shock waves. That often heard word, compressibility, simply means that the speed of the plane approaches the elastic limit of the air, causing compression shock waves, with loss of control, and all the other notorious headaches of the dread transonic region.

Since 1927, NACA has been amassing knowledge of this compressible flow over airfoils in wind tunnels with speeds from 700 m.p.h. to 2,000 m.p.h. But no one has devised a suitable transonic tunnel, thus forcing the development of other means of gathering data in that mysterious region. Both above and below the speed of sound, air flow poses few mysteries. But when the two are blended into a mixed air flow the problem becomes discouragingly complex.

As the reader knows, some of the parts of a plane will reach the speed of sound before others, for the simple reason that air forced to detour a canopy, a wing root fillet, even a rivet head, is speeded up locally, with the strange result that a ship traveling at, say, 550 m.p.h. may have parts of its structure moving, with respect to the air flowing over them, at supersonic speeds. Consider then, that flow over part of the ship is subsonic (smooth and orderly) while that over other parts may be supersonic (accompanied by shock waves). Combined, these conditions are chaotic. If it were possible to design a plane whose parts would arrive simultaneously at the speed of sound, there would be no transonic region.

The NACA likes to use the convenient double-wedge airfoil to explain the peculiarities of supersonic flow. The division of air flow over and below this section is likened to a crowd of people encounter- (*Continued on page* 76)



Photograph of Earth from 100 miles illustrates tremendous areas a satellite vehicle could command. This picture shows approximately 500,000 square miles of southwestern U.S. and northern Mexico. Top to bottom is 900 miles; horizon is 500 miles long.

CAN WE BUILD A *Station in Space?*

By R. P. HAVILAND

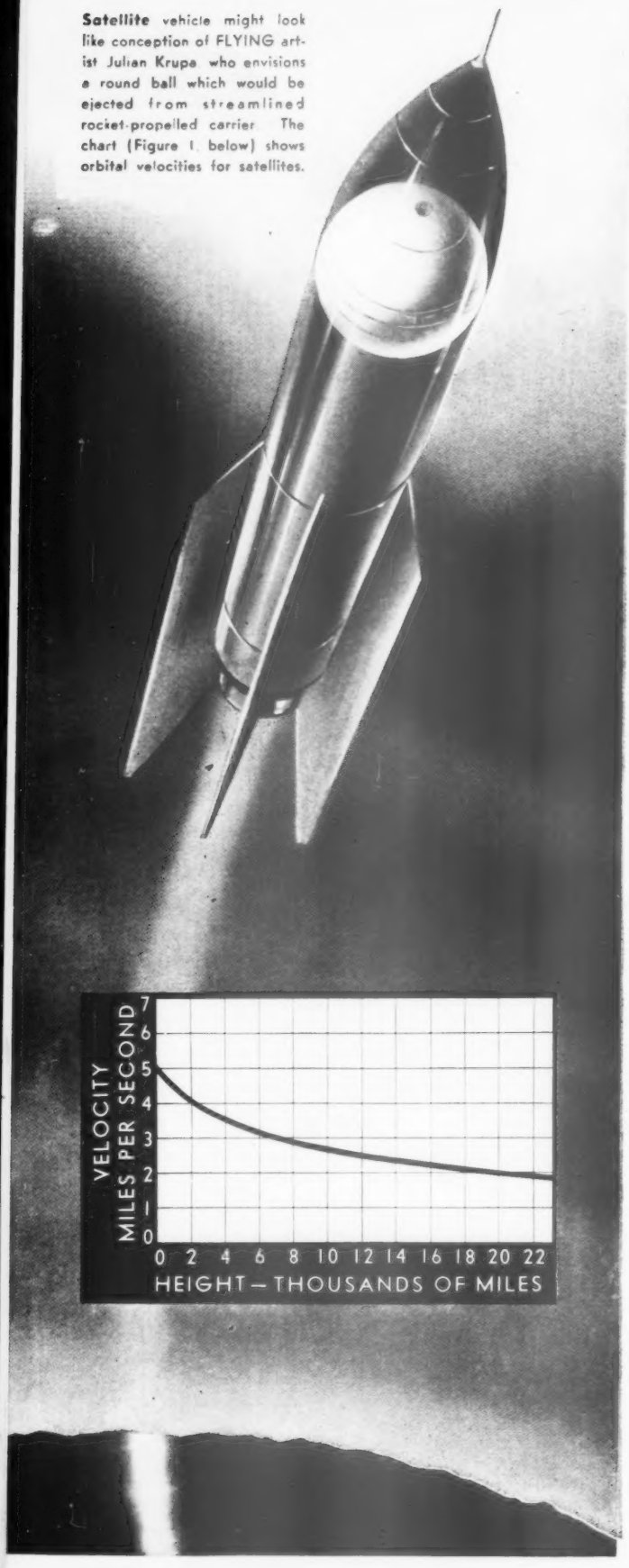
Member, Project Hermes, General Electric Company

ROCKET EXPERT

R. P. Haviland is a rocket engineer. He served as a Naval research worker in rocketry from 1942 to 1947. He is now a member of Project Hermes, established at the General Electric Company to carry out applied research and development in guided missiles. One of the developments of Project Hermes was the two-stage rocket vehicle which set a new altitude record of 250 miles last February. So far as is known, Project Hermes is not working on satellite vehicles, and this article represents Mr. Haviland's own opinions only.

THE concept of the satellite rocket involves the placing of a rocket propelled vehicle in an orbit about the earth, and the utilization of the vehicle for scientific research, development engineering, and later, for industrial and other purposes. It should be noted that the rocket is described as a vehicle, rather than as a missile or a ship. This discussion is not concerned with the satellite rocket as a weapon nor does it consider the carriage of passengers. These represent other lines of development.

The major reason for the choice of satellite operation is that once the desired orbit is attained, no further expenditure of energy is required to maintain the orbit indefinitely provided that certain disturbing effects, such as the presence of the earth's atmosphere, are properly considered. In practice, in the early stages of develop-



Satellite vehicle might look like conception of FLYING artist Julian Krupa who envisions a round ball which would be ejected from streamlined rocket-propelled carrier. The chart (Figure 1, below) shows orbital velocities for satellites.

ment, it may not be possible to satisfy the conditions for indefinite operation, so that after a few weeks or years the vehicle will return to earth.

The simplest orbit, and the one which appears to be the most desirable for nearly all purposes, is that which maintains essentially constant height above the earth's surface. The requirements for orbits of this type may be completely specified by determining the velocity the vehicle must have as a function of height, with the velocity being measured along the tangent to the orbit. This orbital velocity is given by the curve of Figure 1 (left, below).

Placing the vehicle in the orbit is, in theory, a simple operation. It is only necessary to arrive at the proper height with the indicated velocity, and with the direction of the velocity vector tangent to the orbital circle. The basic techniques for this operation are well known.

Considerable effort has been spent on the problem of simplifying the placement of the vehicle in the orbit by selection of the best ascending trajectory. The method which appears to be nearly optimum is essentially as follows: the vehicle takes off vertically, and after a few seconds starts to turn toward the horizontal. The turning continues until the path is just a few degrees above the horizontal, at an altitude of about 50 miles. Thereafter, the vehicle continues on this course until it attains a velocity determined by the height of the desired orbit.

The propulsion system is then shut down until the vehicle arrives at the desired orbital height, at which time the propulsion system is again started and a final velocity adjustment made. The trajectory of such an ascent is

U. S. MILITARY RESEARCH IS NOW

SHORTLY AFTER U. S. reaserch teams penetrated Germany, American newspapers were splashed with headlines about a fantastic German project to build a gigantic mirror in space. The mirror would focus the sun s rays at will upon enemy targets. It would be a fearsome weapon, presumably beyond reach of attack. Although the first revelation of this "sun gun" was made by Lieut. Col. John A. Keck, chief of the U. S. Ordnance Service's enemy technical intelligence branch, actually it was not a new proposal. Capt. Hermann Noordung, a German engineer, first published a pamphlet on the idea in the late 1920's.

Only recently, however, have rocket developments advanced to the point where a satellite vehicle has become a technical possibility. Reputable engineers say it is probably about in the same development relationship to success as Lindbergh's *Spirit of St. Louis* stood to the B-50 that flew around the world nonstop.

Former Defense Secretary James A. Forrestal recently revealed that the national military establishments are doing research on earth satellite vehicles. Actually, such a program has been underway since the early days of World War II. This development is taking at least two lines, according to reports. One is a study of space stations (such, possibly, as the German "sun gun") and the other is of satellite vehicles.

In the accompanying article, Author Haviland discusses the satellite only for its possible peacetime uses. Among them would be as a weather station to televise a continuous picture of the earth's weather over a vast area. A second would be as a short wave relay station. Mr. Haviland does not refer to the military possibilities of a satellite vehicle, but it is

shown in Figure 2 (page 68), with the two burning periods shown as heavy lines and the coasting period shown as the lighter solid line connecting these.

The velocity at the end of the first burning may be called the take-off velocity, and the velocity on arriving at the orbital height may be called the arrival velocity. Computation of the take-off velocity is quite complex; however, it may be approximately determined by assuming that the first part of the take-off trajectory is the dash line in Figure 2, by assuming that the vehicle can instantly develop any desired velocity, and by neglecting air drag. See Figure 3 (page 68) for these curves.

The so-called ideal velocity, which is the one used for mass ratio calculations, is the sum of the take-off plus the orbital velocities, less the arrival velocity, plus several corrections to take into account the loss in velocity due to air drag, gravitational attraction of (*Continued on page* 68)

UNDER WAY ON SATELLITE VEHICLES

here that its possibilities are most ominous.

Artificial satellites, circling the earth, could be ready to plunge at any earth target upon receiving proper electronic signals from some buried control room. Or they could be automatically triggered to fall when they reached a certain specific position determined by the position of the stars. The proposed space mirror, which would have to be 22,000 miles from the earth, could focus rays of the sun to dry up lakes and rivers, start fires, and kill anything within reach of its deadly rays.

Rocket research is progressing constantly to create these new devices in the not too distant future. Prof. H. L. Johnson of the Ohio State University Chemical Department has announced that recent laboratory experiments with liquid hydrogen rocket motors have produced sufficient energy to propel an object beyond the earth's gravitational pull. All that is holding back space travel apparently is the lack of a vehicle strong enough to withstand the terrific stresses and temperatures generated by the new fuels.

German V-2 rockets traveled at a maximum speed of about 3,600 m.p.h. The two-stage rocket vehicles which set the new 250-mile altitude record at White Sands last February attained a speed of 5,000 m.p.h. But the new hydrogen fuel, Dr. Johnston says, can propel a vehicle at 30,000 m.p.h. This is faster than the speed necessary to escape the gravity of the earth, and is considerably more than the speed necessary to propel satellite vehicles which need not escape from the earth's gravity.

There is strong evidence indicating that the U. S. Government is already conducting research on a satellite vehicle which will be capable of traveling as fast as 10,000 m.p.h.

—Curtis Fuller

I Flew For Israel

A 20-year-old Chicagoan fought for the Israelis. This is his dramatic story.

By ROBERT J. LUTTRELL
AS TOLD TO JOHN H. THOMPSON
Military Editor, The Chicago Tribune

Author Luttrell examines Egyptian knife given him by Jewish officer who used it to kill 18 Egyptians.

WE CLIMBED steeply from the Aquir airfield near Tel Aviv, our old C-46 shadowing the dun and green coastal strip of Palestine. Off the starboard wing lay the blue haze of the Mediterranean. Ahead of us were the Egyptian lines, nearing rapidly as we approached 10,000 feet.

I lay flat on the belly of the cabin, peering through a window cut in the floor, sighting with my "bomb sight," an astro-compass. (Other bombardiers used German bomb sights.) When I figured we were one minute away from the port of Gaza, terminal of the Egyptian lines, I poked my head through the cargo compartment door.

Our mechanics, standing beside the open door of the plane, took the appearance of my head as a signal for action. Pushing, heaving, rolling, and kicking, they started dumping fragmentation bombs through the doorway, to fall on what we hoped were the enemy positions.

The mechanics were our "bomb-kicker-outers." I was the "bombardier." And that's the way Israel bombed the Egyptian invaders in the early days of the Palestine war.

A year ago March, I never even dreamed of flying for the Israelis. I'd flown only once, as a passenger in a commercial American plane. By profession I was a ship's officer in the merchant marine. The idea of becoming an aerial navigator, of navigating a plane across the Atlantic, of smuggling arms, ammunition, and planes from behind

U.S. B-17 was impounded by Canadians, then flew to Azores, and finally showed up at Zatec, Jugoslavia, whence it was flown to Israel.

Arab plane overhead! A Jewish Bren gunner in North Palestine fires on attacking enemy bomber.

Jeep commandos (note girl radio operator) prepare for quick strike at Arab positions. Between flight missions, Bob Luttrell joined several jeep raiding parties in Negev.

the Iron Curtain to Palestine, of going on front line raids with jeep parties of Israeli commandos, of dodging "ack-ack" over the Negev, of sniping in Jerusalem, never even crossed my thoughts.

They wouldn't have become fact for me if I hadn't stuck out my neck during a bull session at the Officers Upgrading school, U. S. Maritime base at Sheepshead Bay, Brooklyn, N. Y. At 20, after four years at sea including plenty of convoy action, and my third mate's papers, I was sitting for a second mate's license, in March, 1948.

The argument turned to Israel and I sounded off. After all, in three years in the forecastle you learn a lot about humanity, and I believed the Jews had as much right to their homeland as did men of any nation. Twenty-four hours later an agent of the Zionist underground asked me if I had the courage to back up my convictions with action. It didn't take me long to decide, and in even less time I was deep in the cloak-and-dagger atmosphere of the Jewish underground.

They signed me up to ship as second mate on the old presidential yacht, the S. S. *Mayflower,* which was being converted into a blockade runner for displaced persons from Europe. But let's get one thing straight right now. I was no mercenary. Many of the gentiles among the 6,000 Gahal, the overseas volunteers in Israel, signed up for money. That's all right, too, but I didn't. I signed because I believed in a cause. I asked only $100 a month, to the amazement of my new bosses, to be sent to my mother in Chicago. By ancestry I'm Scotch-Irish, but since I was going to Israel as an idealist, I told the underground I was Jewish and I was accepted everywhere as a Jew. It helped me to know some mighty fine men a lot better that way, too.

The *Mayflower* deal fell through after a couple of months. Federal agents impounded the ship and the crew was dispersed. (Later the ship sneaked away and is now in the Palestine trade as the S. S. *Mala.*) I spent several weeks with these new friends of mine in the *kibbutzim,* the youth camps run by various leftist and conservative young Hebrew organizations in New York and New Jersey, even helping shift heavy crates which I was told held TNT, pistols, or ammunition. Later I was broke again and trying my old shipping line for another berth, when again an underground agent found me near a subway entrance, slipped a note into my hand, and vanished. Once more I was with the underground.

This time I was on the books as an aerial navigator. As a hobby I had studied celestial navigation, which proved handy background for the intensive 10-day course I received. This was given me at night in the Yonkers home of a New York lawyer who had been a navigator and instructor in the Army Air Force during the war. Checked out by him, I flew commercial to Panama to meet for the first time the members of *Lineos Aeros de Panama Society Anonyme* or, as we called it, *LAPSA.*

LAPSA posed as a new airline surveying a route across the South Atlantic but, curiously enough, no *LAPSA* plane ever returned to Panama. In Palestine *LAPSA* became the Air Transport Command of Israel. When I reached Israel in May, *LAPSA* was operating eight C-46's, and two four-engined jobs. Later we had three four-engined transports, 12 C-46's and numerous C-47's. Most of these were purchased, with American Zionist funds, as war surplus in Burbank, Calif., and elsewhere. Other groups bought planes in England, Europe, and Africa. In time, in addition to *LAPSA,* Israel had a real air force which included Messerschmitt and *Spitfire* fighters, three B-17 *Flying Fortress* bombers, and such planes as Piper *Cubs,* Lockheeds, Beechcraft, *Lancasters,* and *Norsemen.*

From Panama, we hopped in stages down to Natal, Brazil, and you can be sure that on the first leg, Panama-Dutch Guiana, I didn't tell the two pilots, radio operator, or mechanic that this was the first time in my life I had ever tried to navigate a plane—first time that I'd ever flown as a non-passenger, for that matter.

Our C-46 was a crate, in every sense of the word, held together by faith and baling wire. They wanted to put in new engines at Natal but there weren't any. Patched up by experts, with extra gas tanks aboard, we made the long 1,885-mile hop to Dakar, our nerves shattered by repeated misfiring. From there our route was Casablanca, Algiers, (where we came down with one engine afire), and Catania, Sicily. "Jerry," the chief Mediterranean underground agent from Rome, was at Catania to meet us. He instructed us about another field at Ajaccio, Corsica, which we later used as a refueling point, and sent us on to Brno, Czechoslovakia. Other agents briefed us on radio procedure and we made the last (*Continued on page* 58)

Navy cadets get one of world's finest aeronautical educations.

The Navy's Air College

By ROBB WHITE

FROM all over the country young men are coming to Pensacola, Fla. They are coming from farms, cities, offices, cow ponies, and they speak with the accents of Texas and Georgia and Vermont. But no matter who they are or where they come from, each has the same desire—to become a Naval aviator.

These are the Navy's new aviation cadets. They are the men who will receive the doctor's degree in aviation, for the wholesale, mass-production of wartime pilots is a thing of the past. The Navy no longer operates flight training stations covering the continent, no longer produces flyers in seven months. Flight training, other than technical and reserve, is now concentrated at Pensacola, with advanced student training at Corpus Christi, Tex.

The training of the Navy's present aviation cadets is the longest and most thorough ever given, the methods of instruction both aloft and on the ground the most scientific.

Rear Admiral
JOHN W. REEVES

As Chief of Naval Air Training, Admiral Reeves is head of the Navy's cadet program. Admiral Reeves is a flying admiral. He commanded several task groups in combat during World War II, and set a remarkable record as commander of Naval Air Transport Service between 1945 and 1948.

Let's take an example. Take you, Joe Jackson. Ever since you broke that window with your first flying model you've had a feeling that the sky's for you. And one reason you've been thinking about the Navy is because it, alone, offers every kind of flying there is. Ram jets, multi-engined sea and land planes, fighters, dive bombers, torpeckers—the Navy flies them all, and in all the world's sky.

You're interested in Navy flying, but you wonder how to get started. You don't know a single senator by his first name, and all the political pull you've got wouldn't drag off your hat. Maybe you live way out in the sticks. Maybe you've been around to see the greetings man at the draft board. Maybe you just think it's too complicated and you haven't got a chance.

Listen, Joe, it's easy. First, you need four things. Check them off:

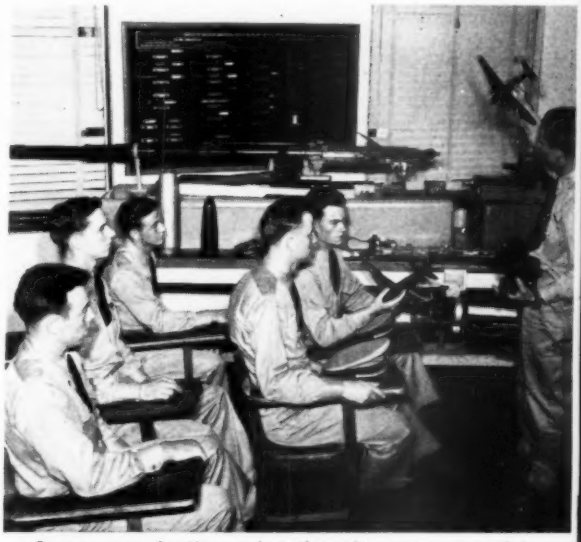
1. Be between 18 and 25 years old.
2. Be physically fit.
3. Have two years of college education or equivalent.
4. Be a bachelor and stay one until you get your wings.

Got them? All right, the next step is just as easy. Remember, you're not asking the Navy for a favor. You're the kind of man the Navy says it (*Continued on page* 65)

To qualify, student Naval aviators must be 18 to 25 years old, be physically fit, have two years of college education or equivalent, and be bachelors. Applications are made to Office of Naval Procurement, Bureau of Naval Personnel, Washington 25, D. C.

Student
make hi
qualifie

Recruits arrive in Pensacola dressed in civvies. They are issued khaki for summer and marine green woolens for winter.



Gunnery, navigation and similar subjects are stressed in ground school. Gunnery training (above) includes a study of effective ranges and vulnerable points on target planes. Student below has just soloed, is getting his necktie cut off.

Student naval aviator climbs into hook-equipped SNJ (Texan) trainer to make his first carrier landing. He must make six carrier landings before he is qualified. Next step for cadets is 14 to 16 weeks of advanced flight training.

Aviation cadets at Randolph Field are issued heavy duty clothing for high altitude flight. Randolph is one of four Texas training bases.

AIR CADETS

Air Force Flight School

Jobs are open with the biggest aviation business in the world.

By

JOHN H. FREDERICK

Professor of Transportation, University of Maryland

THOUSANDS of young men, clutching crisp college sheepskins, will start looking for jobs in aviation this June. Most of them want positions in commercial aviation but they're going to hear a sad refrain from scores of airline personnel managers:

Airlines are not expanding. Probably not since the beginning of air transportation have so few jobs been available with commercial operators. The door is almost shut and only a few with particular talent or training will squeeze through.

Where, then, can these college graduates get a start?

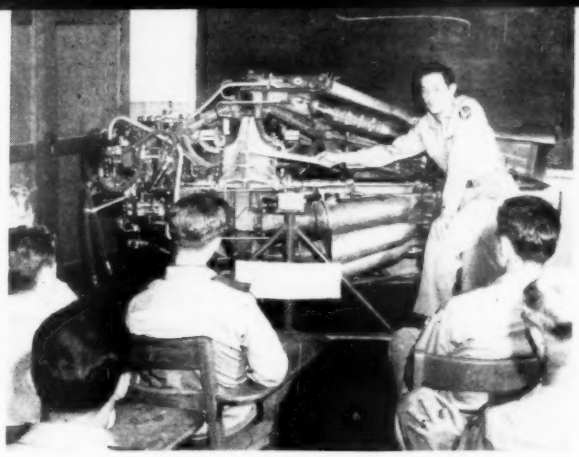
One place—with the biggest aviation business in the world, the United States Air Force.

The Air Force is definitely in the market for college men. If qualified, they can start training this summer or fall and in a year they will have wings, reserve commissions as second lieutenants in the United States Air Force and a three-year assignment to active duty. Air ROTC graduates can go through their entire training as officers. Men entering ground training go to Officer Candidate Schools for six months. Then they are commissioned and are assigned to three years' active duty, which includes some form of advanced air specialist training.

Top pay is, of course, in the flying side of the Air Force. But salary is not the main attraction. The year's training course is worth $35,000. It is superb training in flight, academic and military subjects—and is excellent background for work in all branches of aviation.

Cadet training today is unlike the pre-war and wartime programs. Instead of the constant emphasis upon speed in training there is an even greater insistence upon quality—both in instruction and in students. Newer and more powerful trainers are used. Classes are smaller and are started more frequently. Married men, who except during the war were not permitted to enroll as aviation

Newly arrived aviation cadets, still clad in civilian clothes, stand at attention while guide explains processing procedure.



Jet engines power all new Air Force fighters. In ground school, instructor explains cutaway model of jet engine used in F-80.

cadets, may now enter the program. Schedules have been revised to achieve better balance between basic and advanced schools. And even the appearance of the cadets has changed—they will start wearing their new blue uniforms this fall.

During the war, cadets started flying primary trainers, then progressed to basic training using BT's, and finished instruction at still another base flying advanced trainers. That's old stuff now. World War II pilots are startled to hear that cadets *begin* by flying the wartime advanced trainer the T-6 (the old AT-6). Soon even the T-6 will be supplemented by the still more powerful 800-h.p. T-28. Most students solo in about 20 hours. All cadets during their year of instruction log 265 hours of flying time—more than enough to qualify for commercial ratings—and they also log enough instrument time to be qualified for instrument flying. Both basic and advanced training last six months.

Classes, which formerly began only three times a year, now begin every six weeks—or eight times a year. This means no more long waits between filing an application and entering training. Class (*Continued on page* 67)

T-6's (Texans), formerly the Air Force's advanced trainers, are primary trainers for new air cadets. From these they go to F-80's.

Seaplane Comeback

Flying boats already have the range. Now they're getting speed.

By MALCOLM CAGLE

Lieutenant Commander, U. S. Navy

BEHIND that smokescreen of atomic dust, biochemical fog and jet exhaust is a browraiser that will surprise many an aviator. Rising from the canvas, bloody but unbeaten, the seaplane is about to pull a turtle in the rabbit race.

Seaplanes, both commercial and military, have been orphans in the aviation family for years; in fact, ever since Pan Am gave them a pink slip back in 1940. In the U.S. Navy, the old faithful PBY *Catalina* has been standard equipment since 1936. Such a fact may make Consolidated's stock jump another point on the Exchange, but it is also eloquent testimony that the seaplane has been anchored for more than a decade. Phenomenal technical advances made by the heavy bombers and fighters during the war were not duplicated by the seaplane. While speed needles on large land planes were pushing close to the 400 mark, seaplanes were chugging along at 120-150, strictly 1918 stuff. Many an anti-sub mission out of New England fields during the last war was cancelled when winter winds got up to 50 m.p.h. or more. On a long patrol, the seaplane simply couldn't make it out and back.

When aviation was still in swaddling clothes, seaplanes were holding their own in the competition with land planes. One of Langley's early machines was a seaplane. Glenn Curtiss, of course, pioneered the seaplane and did much of aviation's earliest research in it. It was a seaplane which first flew the Atlantic Ocean. But about the time of the Ford Tri-Motor, and the mushrooming of modern hard-surface airfields all over the United States, the seaplane seemed destined for the commercial junk heap. Before American aviation could start to fly oceans on a money making venture, it was first necessary to fly cross country.

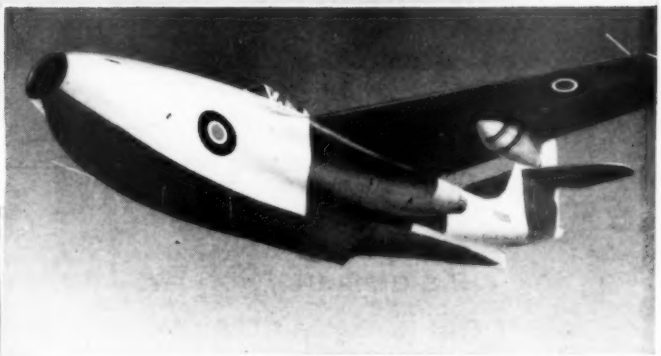
Today, however, the outlook is substantially different. Progress, know-how and science have given the seaplane a belated hypodermic. New engines, new metals and new hulls have added a blast of water injection, and new problems have arisen which have brought this reluctant dragon to center stage into full spotlight. One of the Navy's aeronautical engineers goes so far as to predict that in the not-so-distant future, seaplanes will be giving land planes a run for the passengers' dollars.

It has been common knowledge for some time that the "state of the aeronautical art" is at a temporary impasse. As planes get bigger and heavier, they unfortunately don't fly faster or go farther. For example, increasing the weight of a plane from 200,000 pounds to 300,000 pounds only increases the range around a pitiful 300 miles. The law of diminishing returns, in other words. Nobody is so pessimistic as to consider this situation permanent; but a great many of our aviation experts *do* think it will take "several" years for the picture to improve. They point

Scaled-down hulls are bolted to Edo-modified Widgeon, used by Navy and NACA to test new designs. Hull (below) is that of Martin XP5M-1.

New "afterbody" hull on Martin XP5M-1 will give better performance than old-style hulls, designers say.

Convair XP5Y-1 will have four turbo-prop engines. The largest seaplane ever built by Convair, it is designed as a Naval patrol boat.



World's fastest flying boat is British Saunders Roe A-1, 550-m.p.h. single-seat fighter. It has two axial-flow turbo-jets.

out that some phases of aviation are years ahead of other phases. Aviation metallurgy is dragging its feet despite tremendous efforts to keep it abreast of 1,000 m.p.h. planes and the extreme temperatures inside jet engines. Aviation gasoline still weighs six pounds per gallon. And much necessary information remains unknown despite prodigious research. What, exactly, will supersonic flight be like? How high can we fly and still fight?

In this ragged state of progress we see the reason for such an enigma as the land based bomber which has the speed but lacks the range, while the seaplane has the range but lacks the speed. The goal, of course, is the true intercontinental plane which has *both* range and speed. It is at this point that the seaplane invades the scene.

For at long last, the water-borne airplane is learning to fly fast. Already the Navy is making daily tests of several new hulls whose aerodynamic silhouettes compare favorably with the familiar *(Continued on page 71)*

Whirlwind effect of thermals can cause trouble for pilots at low altitude. Artist's sketch shows characteristics of typical thermals.

The Wind and You

It's a smart pilot who knows his thermals. These tips can give you greater lightplane range, fun and safety.

THE TWIN CESSNA was making its approach in good soaring weather—that is, a day with a normal amount of instability. Suddenly the plane sank rapidly toward the ground. At the same time, the engines speeded up. As it touched the ground in an apparently normal landing with full power, the pilot cut the throttle.

Since the landing was short, the pilot taxied about 3,500 feet to the spot where I stood. As he got out, I recognized my friend, Cecil Lesher of San Bernardino, Calif.

"Gus, I'm sure glad I took that soaring instruction with you," he said. "Did you see how I saved this ol' goat from a hard landing?"

He explained that the air wasn't unusually rough, but considerable thermal activity was noticeable—so on his approach he was on his toes in the event of a thermal with accompanying wind shift or change of wind direction. As he anticipated, his airspeed bounced up suddenly to 105 m.p.h., then down to 70 m.p.h. When he started to sink, he applied full power but still landed far short of his goal.

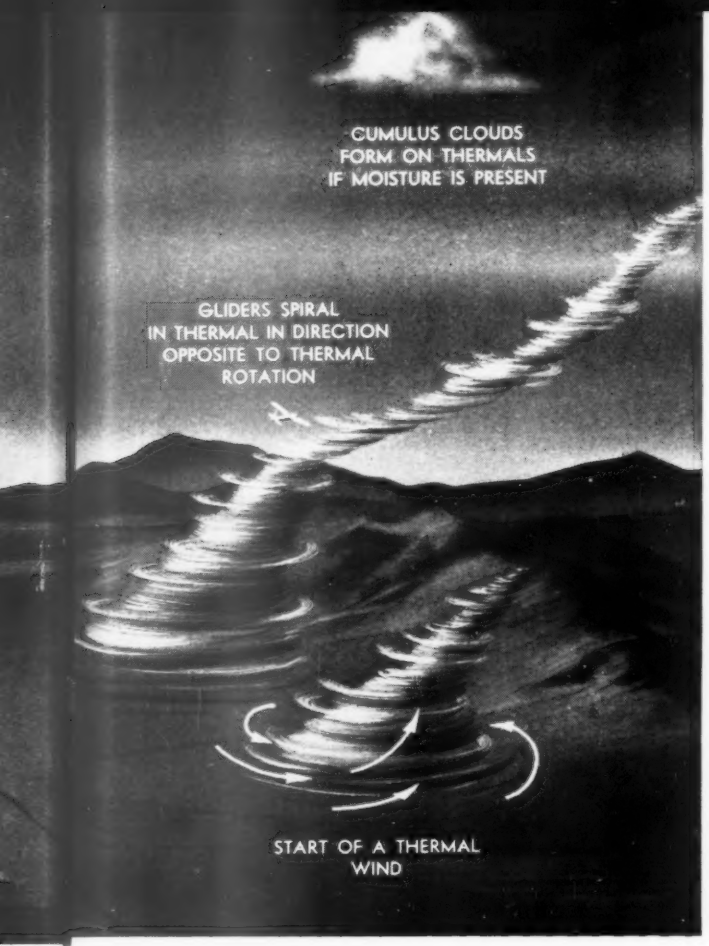
That has happened to thousands of pilots flying in unstable air in all parts of the world. It is especially apt to happen in spring, summer and early fall when the hot ground produces thermal activity.

Take a look at thermals:

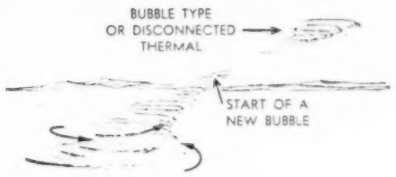
When they begin to generate upwind of you, they effectively reduce the expected headwind velocity. When a thermal pops, so much air starts skyward that the air from behind your plane is sucked into the rising mass. This drastically reduces your headwind and may even leave you floundering around in a tailwind.

By WILLIAM G. BRIEGLEB

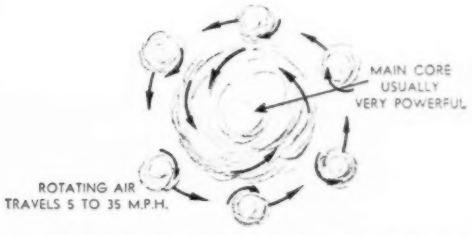
A glider designer and pilot with 20 years' experience, Briegleb is head of Briegleb Aircraft Company at El Mirage Field, Adelanto, Calif. He is a director of the National Soaring Association, and also a director and past president of the Southern California Soaring Association.



ALL THERMALS AREN'T ALIKE



Bubble type creates several disconnected thermals.



Complex type is surrounded by small, spiralling thermals.

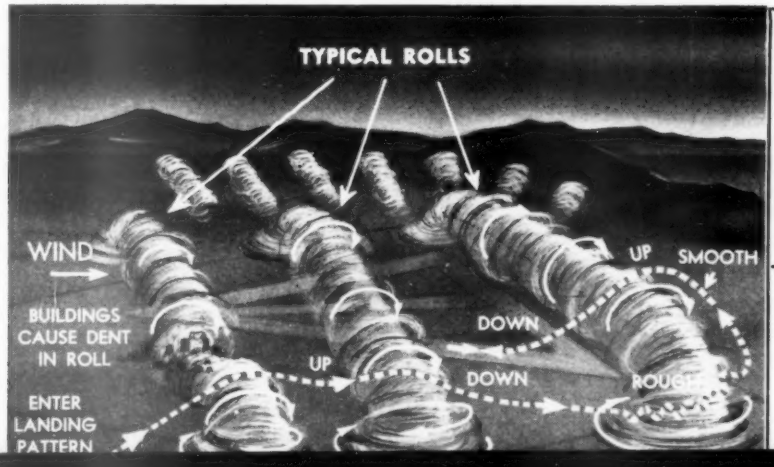
Inverted thermals, though rare, have strong downcurrents.

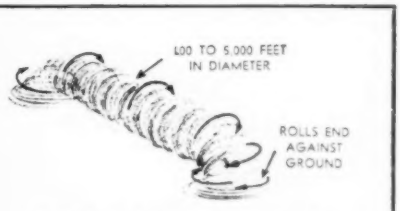
What happens if you hit a thermal head-on at low altitude—on take-off or landing? First, there may be a gentle sink that escapes your attention. Or maybe you pull back a little. Then you fly into lift. Your airspeed jumps, so you pull back a little more. Often you don't anticipate the drop on the far side of the lift. That can be acutely embarrassing.

Arguments about whether the downcurrent "flares out" near the ground are beside the point. Here's why: We know that thermals rotate; dust devils, cyclones, tornadoes prove it. If you hit one a glancing blow, your loss in airspeed may not be entirely the result of down-current. The "whirlwind" may have struck you from behind. That kind of wind shift is effective right down to the grass roots!

Sometimes it is difficult to distinguish between thermals and gusts—or gusts and wind "rolls." They feel almost the same under most conditions. As a soaring instructor, I have found almost unbelievable conditions in the atmosphere and appreciate the limited knowledge of the average private pilot (glider *and* power) concerning vertical development of the air mass. At El Mirage we can study

Ground turbulence caused by rolls of air can be annoying, sometimes dangerous. Most pilots have had landing patterns like the one below.





Rolls look almost like a towel rack.

these phenomena as they occur above the dry lake adjoining our field. The fine particles of dust outline the various conditions.

The standard thermal starts as a heated bubble of air, and rises either as a column or elongated bubble. The column type sometimes reach altitudes over 20,000 feet. I have seen these columns carrying dust higher than 15,000 feet, and have soared in them to 19,500 feet. Tops of these thermals sometimes result in cumulus clouds whose base is 23,000 feet above mean sea level. George Rounds of Marquardt Aircraft Company has soared a loaded *Navion* with throttle retarded, and noted an indicated climb of 2,000 feet per minute at 1,500 feet above the ground. This same thermal, witnessed by several persons including Round's passengers (who were engineers for Marquardt), lifted the roof of a gas station on a nearby road and shifted it six inches out of line. Rounds claims the ensuing downdrafts surrounding the giant thermal were equally severe at 1,500 feet.

In studying "dust devils" or visible thermals, I have noted complex conditions from 500 feet down to the surface of the earth. Thermals vary from 10 feet in diameter at the base to over 1,000 feet, with accompanying downdrafts and wind-reversal areas extending beyond this area to a distance larger than the thermal base. In other words, the down area and wind reversal area can cover the ground from the edge of the thermal outward for another half mile. Assuming a plane is making its approach at 65 m.p.h. into a 20 m.p.h. wind, and that the pilot is on the side of the thermal in which the rotation of the down air is with him, he can go from an indicated gliding airspeed of 65 m.p.h. to 40 m.p.h.—or stalled condition—at any altitude down to the ground. As the plane enters the downdraft and "reversed wind" side, the pilot's only hope to prevent a serious accident is to nose down immediately and apply full throttle until clear of the "bad air area."

Glider pilots at our school are taught to increase their airspeed below 500 feet at least 25 per cent above their normal cruising speed (which may be just three miles above stall, to obtain minimum sink when soaring). In very turbulent air, the glider pilot is instructed to increase his let-down speed even more. If he is aware of a thermal in his vicinity during let-down, he does all he can to avoid it—or if he is in the downdraft, he immediately noses the glider down to get out of the area as fast as possible.

We have reason to believe that wind sometimes comes billowing over flat ground—or over water—in great, slow pulses which are effective to an altitude of 8,000 feet or so. These pulses are gusts, and strong ones are rare. The usual gusts, however, spring from ground turbulence or thermals and are common, annoying, and sometimes dangerous. Ground turbulence is usually in the form of "rolls" which constitute a form of gaseous "roller bearings" on which the atmosphere rides over the earth's surface. By taking advantage of this type of roll condition, an experienced power pilot can ride the up side and gain altitude more rapidly than under ordinary conditions. He can do the same thing in thermals. Only recently, a friend of mine, George Cooke, a former Army instructor, told me he used a thermal to take his Luscombe to 10,000 feet with full load, thereby saving time and fuel getting into Big Bear, Calif., airport. He used the same technique getting out of the field.

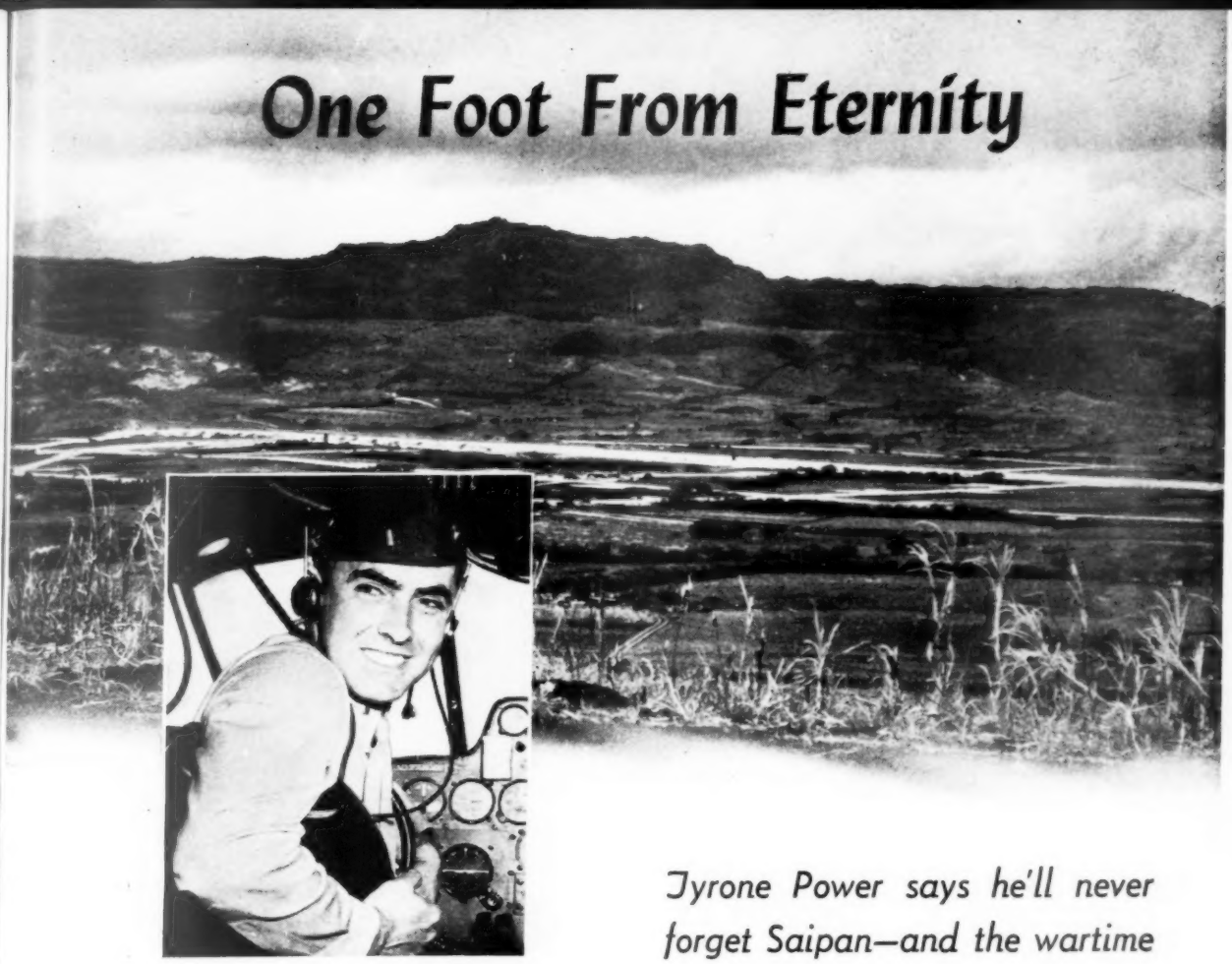
It is, consequently, easy to see why flying gets rough near the ground even in fairly quiet weather. Recently we have soared gliders on the "up" side of these rolls in exploratory flights. It is tricky, and if you fly off the end of a roll (an easy mistake), you drop sharply in rough air. From our investigations it seems that the rolls sometimes lean over and lie flat against the ground. Frequently the rolls are cut up by thermals. You never know when you might be flying in a roll, parallel to its axis, on the base leg of an approach. If you are, you may be either in the up side or the down side. The jolt you will get as you make your last turn had better be "covered" by a little extra speed or power. Just as a rule of thumb, remember that rolls can get mean when the wind velocity exceeds 20 m.p.h.

Combinations of thermals, rolls and ridge currents roil the air considerably. It is difficult to plot air currents in a particular location. They change with the air mass source (Polar, Gulf, etc.), the season, the wind velocity, the frontal conditions, and the hour of the day, just to mention a few factors. Pilots familiar with the terrain don't have to worry about these factors; they know what to expect and are seldom caught napping. And they shouldn't instill fear in students by telling bogey tales about the "cruel, mad wind currents waiting to pounce." They should explain that, with enough speed and power and the habit of being alert, no one should *ever* be tripped up by wind.

When landing in boisterous weather, a wheel landing is sound judgment. If you approach slowly, with your nose way up, you are leading with your chin. A juicy thermal can lift your plane even if you are already on the ground. Bob Symons, who flies everything (*Cubs*, P-38s, gliders) in the vicinity of Bishop, Calif., had this happen to him: With a passenger, he landed an all-metal sailplane at Bishop one afternoon in an almost dead calm. But a thermal was developing ahead of him and was rushing down the runway. As the plane rolled along, the tail kept lifting. Bob pulled the stick back, but couldn't get the tail down. The thermal was sucking so hard he had a tailwind. Then, so violently that Bob and his passenger "grayed out," the thermal kicked the (*Continued on page* 54)

Dangerous conditions often exist on lee side of hills. Carry plenty of power when landing, as thermals can cause unpredictable wind patterns for three miles or more.

One Foot From Eternity



Author piloted a Marine Corps C-46 transport during the war.

Tyrone Power says he'll never forget Saipan—and the wartime error that almost cost his life.

By TYRONE POWER

WHEN I THINK of Saipan, I think of the Marines and the C-46 I jockeyed around the Pacific during the war. And every time I climb into a cockpit, I force myself to re-live a hellish 30 seconds or so I spent on Saipan while starting a routine flight mission. I re-live those seconds because they taught me a flying fundamental I don't ever want to forget.

All pilots know you can't overlook the check list. It gets to be almost habit after a while. If you've logged hundreds of hours in the same type of plane you give it that pre-flight check automatically—you go back, you go forward, you go down, you go across the instrument pattern.

During the war I flew a Curtiss *Commando* week after week, month after month. I think I knew its insides better than I knew what was in my pockets.

And—like a lot of other pilots—I got careless.

The hydraulic system on the C-46 is somewhat complicated. Under the conditions we flew the planes, the seals for flaps and gear had a tendency to dry up easily. We had to actuate them frequently to keep the actuating cylinders flexible and to make certain we'd lost no fluid from dried seals.

So, habitually, I'd actuate the flaps while waiting on the line—just to make certain everything was all right. I'd flip them up and down, up and down.

Then, taxiing, I'd flip them up and down again.

In our squadron it was SOP to go through three full cycles on the flaps. First, on the line or in the revetment, again while taxiing for take-off, and once again after final mag check.

That morning on Saipan I was hauled out of bed at 5 o'clock for a rush flight to Okinawa with a heavy load of materiel and four or five men. I picked up my co-pilot—a new one, checked the plane, and we were ready to go.

I wanted to be extra certain those flaps were okay, just in case I should need them on take-off. I made the prescribed check in the revetment and another one while taxiing for take-off. Then, while we sat there on the end of the runway waiting for a bevy of planes to take off, I checked it again. We went through the entire check-off list.

My co-pilot got clearance, nodded to me, and off we went.

The C-46 scuttled down the runway while I kept watching for the prescribed number of inches on the manifold pressure. I knew immediately something was wrong. The plane wanted to come off in about 1,000 feet! And we were loaded to the gunwales.

Down the runway the plane barreled, trying to pull off, with me pushing hard on the yoke to keep it on the ground. Second by second we were eating up that runway, roaring toward the end—(*Continued on page* 52)

STANLEY HILLER'S *New Windmill*

Enclosed version of helicopter hovers as Author Littrell motions pilot to come down and pick him up. The machine sells for $19,950 f.a.f.

Functional Hiller 360 is longitudinally stable, easy to fly.

By GAITHER LITTRELL

Contributing Editor of FLYING

IN THE late 1930s, everybody talked about owning a helicopter. They were going to park it in the backyard and lick the traffic problem by flying to work each day.

Then came disillusionment. The general public was sharply reminded that helicopters were too intricate for the average man to control. Only a few expert pilots in the U. S. were certified to fly them.

So the public, staring over the steering wheel and plagued by red lights, sat back to await production of a windmill craft that would be easy to fly.

The easy-to-fly helicopter has now been developed. It still costs too much ($19,950 f.a.f.) for the average man. But because it's simple to operate, inherently stable and functional in design, it is one of the most interesting recent developments in the helicopter field.

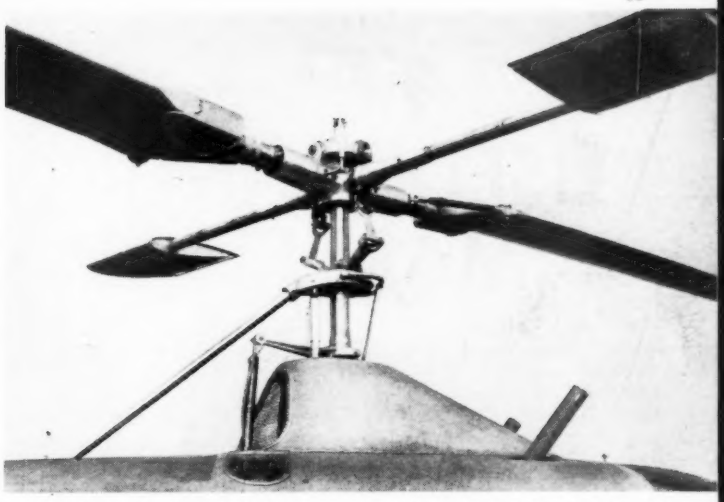
The CAA recently approved the "Hiller 360," designed by 24-year-old Stanley Hiller, Jr., of Oakland, Calif. The craft, built by Hiller's United Helicopter Company at Palo Alto, Calif., will be produced at a one-a-day rate this summer. Shortly after the first of the year, the company reported it was six months behind schedule on current orders—not counting test contracts for the military.

Following certification of the 360, I flew it. I tested the ease of control claimed by young Hiller. And, though I am not a licensed rotor wing pilot, I found the 360 amazingly simple, easier to fly than many conventional-type airplanes.

With Hiller at the controls on a backward take-off—the three-place craft actually swooped backward for about 50 feet while climbing to nearly 100 feet altitude—the 360 momentarily hovered, then swept forward and climbed. At 1,500 feet, without a ground check-out, I took over.

Basically, the simplified control consists of an overhead control stick, of inverted Y-shape for both hands, connecting through a simple linkage to a servo-control rotor. Rudder pedals control a paddle-type tail rotor, which is

Yoke-like control functions like stick in conventional plane. Overhead location eliminates cables, pulleys, levers.



Control rotor (small blades) is unusual feature of the helicopter. The pilot actually flies the control rotor. It, in turn, actuates large lifting rotor.

linked by a drive shaft to synchronize with the main rotor.

The yoke control stick functions exactly like the stick of a conventional plane—to raise the nose, it is pulled back; to turn, it is moved in the desired direction.

There is so little vibration through the stick or in the craft itself that it is hard to believe you are flying a helicopter.

The overhead control stick eliminates all of the cables, pulleys and levers found in conventional helicopters. In turn, the control rotor is a simple aerodynamic device which controls the main rotor.

The small control rotor incorporates low lift curve slope airfoils, extending from the rotor head, between the large lifting rotor blades.

The pilot actually flies the control rotor rather than the lifting blades. Cyclic pitch is put into the small control rotor by the control stick. The resulting cyclic flapping of the control rotor blades puts cyclic pitch into the lifting rotor to effect control.

After an hour's flight, in which the 360 was kept at 80 m.p.h. for a long period, hovered steady at 6,000 feet for many minutes, and tested "hands off" control near the ground, I was convinced of this:

The Hiller control rotor invention has changed a helicopter from a tricky machine requiring a highly skilled pilot, to a two-control craft that can be commanded with almost as much ease as motorists maneuver their cars.

The control stick has a smooth, light "feel." This is a feature built in by springs, which force the stick to neutral control. And it is this feature which makes hands off control possible.

The centering springs give the pilot a "feel" sense of his stick's displacement, and discourage overcontrolling by beginners. They also prevent the pilot from inadvertently taking off with the lifting rotor tilted as the result of an uncentered control stick, and provide simple trimming means.

At six feet off the ground, after the 360 had been flared in for a landing, Hiller vividly demonstrated flying qualities that are far better than many rotor wing pilots and designers once believed possible.

By setting trim tabs, he hovered the craft hands off for 45 seconds. Afterwards, he revealed:

"Airplane pilots with no previous helicopter time have been taught to hover this craft in as short a period as eight minutes."

Veteran helicopter pilots who have flown the 360 are enthusiastic. Frank W. Peterson (who has amassed 500 hours in Sikorsky R-4, R-5 and R-6, Platt Le Page R-1, Kellet and Bell helicopters, and who has flown 400 hours in the Hiller 360) says "no other helicopter I've ever flown approaches the controllability characteristics of the 360."

Peterson points out that the 360, unlike other licensed helicopters, has no direct control to the main rotor blades; instead, control is achieved by moving light control rotors, which in turn make the stick light and smooth. "The rotor-matic control," he says, "makes the Hiller 360 inherently stable. Particularly from the pilot's point of view, this is the greatest development in helicopter control since the first flights of the Sikorsky VS-300 in 1939." He adds that the Hiller 360 has flown the 20 miles from Palo Alto to Mills Field in San Francisco without anyone touching the controls.

Jay Deming, another former helicopter test pilot, confirms Peterson's opinion. "Flying the 360," Deming says, "is done in more the relaxed manner in which a *Cub* is flown. The cyclic control stick no (*Continued on page 73*)

Light craft (1,147 pounds, empty) can be pulled by hand. It cruises at 75 m.p.h., has a ceiling of over 10,000 feet, range of 200 miles.

The USED PLANE MARKET

Aircraft brokers George (left) and Powers.

By

W. HAYWARD POWERS, JR. and PHILIP E. GEORGE

of Powers & George, Aircraft Brokers

WHEN the competitive market for automobiles existed (and it is now fast returning), smart automobile dealers realized they were not essentially in the *new car business;* they were in the *used car* business. Statistics showed that for every new car sold, three or five, or sometimes even more used cars had to be sold. The dealer knew he had to sell the trade-in, and then that he had to sell the trade-in for his first trade-in.

And so it went, not forever but until all classes of buyer and pocketbook were satisfied and had the cars they wanted or could afford.

This situation exists today in the airplane business. There are very nearly 100,000 airplanes in the United States, and considering every plane manufactured last year as still being new, there are 90,000 used planes. There are many new plane buyers, *but there are many many more used plane buyers.*

Just as automobile manufacturers have gone through an abnormal period in the past three years, so has the private plane industry—but the pattern has been strikingly different Auto makers worked at top capacity through the three years to satisfy the demand for new automobiles—as much to replace deteriorated machines as to meet the demand from an increasing middle income class. The aviation industry had one peak post-war year, due mainly to the demand for trainers. It did not, as many enthusiasts thought at the time, fill any long-time demand for new personal aircraft. The expanded aviation industry used its tremendous wartime manufacturing potential to flood its market.

As with automobiles, airplanes have to be floated down through various income levels to sustain a demand for new planes. It has taken two years to set forseeable manufacturing schedules, establish comparative values and to control in some measure the great number of used planes dumped on the market as a result of the one abnormal peak year. The effects of 1946 will probably be felt for several more years to come but at the present time, used plane values and new plane prices are beginning to maintain a steadier and more predictable relationship.

A stabilized used plane business, by providing a firm

Lineup of planes at Waukegan, Ill., airport typifies situation at many U.S. fields, where buyers can find bargains in most categories.

What's the status of the used plane market?

secondary market for trade-ins and lower income buyers, should do more to establish a pyramidal base for future new plane sales than any other factor in today's personal aviation picture. The scarcity of certain types of preferred planes in today's market has kept the prices of those planes closer to new model prices than is the case with other, more numerous and more easily available types.

Used plane prices are decided solely by supply and demand.

The only aircraft that actually glut the market today and can be picked up for a song are war surplus, pre-war personal planes or fabric-covered trainers. A plane without a battery, starter and generator or one that is not radio-equipped has little chance in competition with the more advanced types. Most of the war surplus and pre-war planes are available for under $1,000.

Naturally, the comparative values of the planes are based on many factors. Among these are (1) the total number of the type manufactured, (2) whether the manufacturer is still in business, (3) comfort and utility of the plane, (4) type of construction, (5) accessory equipment installed, and (6) the amount of damage done to a plane's reputation by harmful rumor and gossip not always deserved.

Very often, the planes that are most in demand are not necessarily the best used plane buys, based on a standard of price for actual value. Several excellent types have had their prices cut because of a combination of points one and six listed above.

Because large numbers of them were built, either in 1946 or 1947, it is easier to find at low prices an *Ercoupe* or Cessna 140 in the two-place field, a Piper *Supercruiser* in the intermediate category and a Stinson *Voyager* in the four-place class. Low prices tagged on some of these planes are due more to numbers available than to any other reason.

We have operated for the past two years exclusively as aircraft brokers, listing aircraft for sale, but neither owning any of the planes nor representing any distributors or manufacturers. We have no personal interest in any of the airplanes we offer. We represent both buyers and sellers and attempt to arrange the best bargain for each, with all fees borne by the seller and calculated on a percentage of the selling price. Because of our position as impersonal intermediaries, listing more private airplanes for sale, we believe—apart from war surplus—than any other company in the world, we have a close working knowledge of the supply, requirements, prices and general depreciation of personal airplanes.

If new plane production this year approximates the output for 1948, as has been predicted, 1949 models will probably depreciate an average of 25 per cent in price in one year. Planes manufactured from 1946 through 1948 dropped approximately one-third in value after one year, but the tapering off of new plane production and the rise in new plane prices has somewhat stabilized the market. If fewer new planes are produced there will be fewer planes of those types available in the used plane market to meet the demand, and consequently there will be less of a drop from the list price.

One indication of a trend in aircraft sales is that winter used plane sales, beginning in January, were much stronger than a year ago, leading to the possibility of a definite upswing in the private aviation curve during the summer.

To give used plane buyers and sellers an idea of values in used planes, the following typical planes and range of prices are currently most active on our books. Planes listed are in large enough supply or demand to give a fair idea of prices, which in many cases differ according to year of manufacture, hours flown and accessories installed.

Aeronca: *Chief*, $1,400 to $1,600; *Super Chief*, $1,600 to $1,800; *Sedan*, $3,795 to $4,000.

Beech: *Bonanza* Model 35 (1947), $6,500 to $7,500; Model A35 (1948), $8,700 to $9,200; *Twin Beech* D18S (1946), $30,000 to $45,000.

Bellanca: *Cruisair* (1946-1947), $3,400 to $4,000.

Cessna: 120, $1,500 to $1,700; 140 (1946), $1,900; 140 (1947), $2,400; several 140s with about 800 hours available at $1,650; 170 (1948), $4,525 up.

Culver: V, $1,600 to $2,000.

Erco: *Ercoupe* (1946), with (*Continued on page* 68)

Ready for buyers, planes line airfield. As in automobile business, sales of used vehicles must exceed sales of new ones, authors point out.

Two sales experts give their frank opinion.

Money-Making Sales Plane

Ken Arnold saves more than $2,000 in annual transportation costs by using his Call-Air for business travel over five states. He cut his total annual travel time from nine months to three.

A BUSINESS PILOT'S REPORT

Ken Arnold earns four times as much money now that he's switched from auto to plane.

By BOB ARENTZ

KEN ARNOLD'S low-winged monoplane with the Roman nose, humped back and big propeller goes almost everywhere. You may see it next to a high-altitude ranch house in Idaho, or parked in a Nevada cow pasture the size of a football field. It might be on the side of a hill in sagebrush higher than the wings, or tied-down along the side of a California stream. Maybe you'll catch sight of Ken taxiing the plane along a twisting dirt road toward a Washington country store.

Regardless of location, it means one thing: Ken Arnold, Idaho's most extroverted traveling salesman, is at work—or hunting—or fishing. The red-and-white *Call-Air* A-3 cost Arnold about $4,500. It is worth approximately $12,000 a year to him as he travels over five states on business for his Great Western Fire Control Company.

The 34-year-old ex-Minnesota football player is a fire control engineer who installs and maintains automatic fire-quenching equipment in rural areas of Idaho, Washington, Oregon, northern California and Nevada. He installs gadgets that automatically put out fires in isolated ranch buildings, small town warehouses, machine shops, stores, barns, homes and dance halls where conventional fire protection is scarce or non-existent. Some of his best customers live at the ends of dirt roads 40 miles from a gravelled highway—and Arnold once spent nine months a year traveling by automobile. He also spent many of the best hours of his salad years swearing at a ton of metal hopelessly stuck in a mud hole, or walking 15 to 20 miles for help.

Now, making four times as much money for half the effort with an airplane, Arnold has expanded his activities to include work as a consultant on fire prevention and

safety measures. His wares range from small glass "bombs" to installations costing $10,000 or more.

The fact that his business is mostly rural once gave Arnold a real transportation headache. He cured it with the *Call-Air*, which not only increased his business four-fold, but saves him over $2,000 a year on the cost of traveling alone.

His automobile transportation costs were astronomical. The kind of car he had to drive costs upward of $3,500 now, and he had to install a 50-gallon gas tank in addition to truck type springs and other equipment. A new car each year cost $1,500 or more in addition to the trade-in value of his old one. Tires every 10,000 miles cost about $960 a year, gasoline totalled $2,500, and his personal expenses on the road ran $1,800 to $2,600—a total expense of from $6,760 to $7,000. These were fixed costs deducted from his commissions as the employee of another company. In addition, he spent about nine months a year away from his home and family at Boise.

Seldom driving less than 50,000 miles a year, in 1941 he drove 58,000 miles, spending about 2,200 hours at the wheel. It required two days to drive from Boise to Tuscarora, Nev., and service the equipment he installed at Bing Crosby's ranch north of Elko. Now he does it in half a day by air—an hour over, an hour back. And he is generally home for lunch if he leaves early.

Home is a magnificent ranch style house on a bluff that overlooks the Boise River and Bradley Field. Arnold calls it, "The house the *Call-Air* paid for."

As for annual costs on the airplane: he flies 600 to 1,000 hours a year and has about 2,500 hours on his present plane. Hangar fees are $240, six 100-hour inspections average $180, gasoline bills total $1,260 and oil is $112 a year. He flies from 70,000 to 80,000 miles, covering more territory than before, yet now spending less than four months away from home. Thus, all other costs for himself and plane average about $2,000. That totals $4,092 as compared to $6,760 by automobile.

He visits 50 per cent to 65 per cent more customers and the drawing power of air travel has raised his percentage of sales. The best year by car was $30,000 gross sales, and that has risen to more than $50,000 a year with the airplane.

An outdoors man, Ken always carries fishing tackle and a gun. The western valleys and farms and their little towns get sticky hot in July and August—110° is not uncommon. It stays muggy all night. So Ken carries a small tent and a sleeping bag in the plane. He spends his nights in the mountains beside cold streams, where he sleeps under blankets. For breakfast he has trout, caught fresh from the stream, and coffee brewed over an open fire. After sun-up he polices the (*Continued on page* 49)

Cow pasture landings are easy with Call-Air, says Arnold. He lands (below) at Schiemer Ranch in Oregon, explains extinguisher to Mrs. George Schiemer (inset).

THE ABC's OF CROP DUSTING

By HARLAND WILSON

AIRPLANES were first used for crop dusting in 1921, when an infestation of caterpillars attacking catalpa trees was successfully destroyed in Ohio. Since then, crop dusting and spraying have become an essential part of agriculture. At least 225 commercial airplane dusting and spraying companies, using perhaps 2,000 airplanes, are operating in the United States. The industry is still growing rapidly.

Plane dusting and spraying now extends far beyond the original purpose of insect control. Airplanes are used for plant pollinization, seeding, crop defoliation, "stop drop" spraying on ripe fruit to lengthen the picking time, fertilizer spreading, and weed control. At least 18 other agricultural uses of airplanes could be added to this list, but these are the main jobs in dusting and spraying.

Poisons to control insects are often applied more quickly and efficiently by airplanes than by any other means. Airplanes have special advantages in forest areas, in isolated or rough areas, when the ground is too wet for surface vehicles, and when speed is required.

The development of DDT to control insects, and 2,4-D weed killer, together with a whole array of new experimental chemicals, has vastly expanded the field of aerial dusting and spraying.

But there are risks in this rapidly expanding business. There are risks in flying, which is always low; risks in organizing dusting and spraying companies; and risks in handling the new and still experimental chemicals.

The use of weed killer, for example, is promising—and dangerous—because 2,4-D will kill valuable crops as well as weeds. In Canada, where 500,000 acres of wheat were treated in 1947, an estimated 1,500,000 additional bushels of wheat were produced on these acres. Canada looks to the day when 25,000,000 acres of wheat will be treated and 50 to 100 million bushels of wheat will be saved. Iowa corn could be increased an estimated 15 per cent. In Oklahoma, an improvement of 20 to 25 per cent in grass pastures is possible with proper treatment. Rice farming in California has had increased yields of 30 to 40 per cent.

That is all to the good, but—2,4-D dust dropped to kill weeds in the South has drifted miles to cause great damage to cotton plants. The chemical doesn't hurt grasses but is sure death to broad-leafed plants such as vegetables. The CAA already prohibits the use of 2,4-D dust. When used it must now be sprayed.

Dangers can also be created with the use of DDT for insect control. Small birds, quail, small animals can be killed by it. So can fish. Cattle eating grass sprayed with DDT may have contaminated milk.

New variations of dusting and spraying are appearing all the time. With the introduction of mechanical cotton pickers, airplanes are being used to spray fields with a dust that defoliates the plant. The leaves fall off and the cotton pickers strip the cotton easily. The opposite kind of treatment is used in orchards, where airplanes are spraying an experimental "stop drop" liquid that makes fruit cling to the tree longer so that it can be hand-picked.

Helicopters are being used experimentally to stir the air and remove excess moisture and dry some fruits—especially cherries—just before picking. The helicopter produces a large downward-blowing draft which fans the heavy dew and rain off the fruit as the craft flies low over the trees.

It is a business of great potentialities. Huge forests are being sprayed in pest control. Woodlands in Pennsylvania, eastern New York and New England are being successfully protected against the gypsy moth. Forestry experts believe that the infestation can be brought under complete control within a few years. The cost? Sixty-eight cents per acre, excluding materials. The tussock moth, which has been killing western Douglas firs, is being similarly attacked. Virtually all crops that are raised in any volume can be sprayed from the air.

Wheat and similar grain crops, rice and range grasses are now sown experimentally from the air. Yet the work requires advanced study. For example, range seeding from the air can be a complete waste of money if certain weeds and bushes are not first removed from the area. This involves ground work—perhaps mowing; perhaps the careful use of fire.

The airplane is best for seeding range lands that are inaccessible on foot. Planting of forest acres is still experimental, and tests in the heavily burned-over areas of New England may determine whether it is practicable. Ordinarily, pine seeds dropped from the air are eaten by birds or rodents. But in the 1947 fires of Maine most of the animal life was destroyed. The seeds dropped there probably will be safe. The most favorable time for such seeding after a fire is usually when the layer of ashes is soft and yielding to the dropping seed.

Test areas have been covered with good stands of grass within two growing seasons after fires. On one sowing job in California's back country, an airplane sowed 10,000 acres in one week. A ground crew of 25 men required a month to sow 3,000 acres in the same "burn."

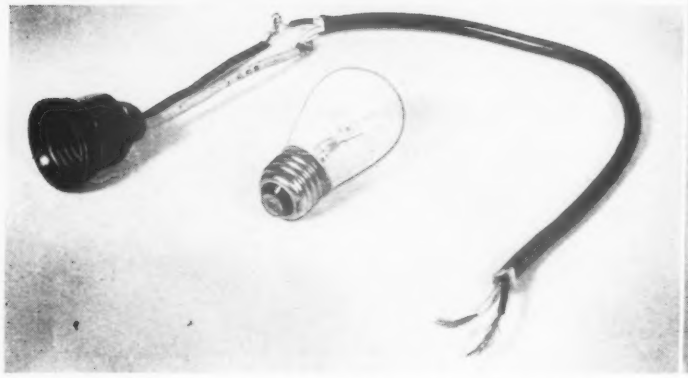
Small experiments have proved that fertilizer dusted on existing stands of range grass and hay has improved crops. So far, no fertilizer has been developed which will starve a weed and feed a grass, but that is a next possible step, because successful fertilizing from the air will depend upon some sort of land preparation that destroys weeds.

Highly successful results have been obtained in controlling grasshoppers and Mormon crickets. These pests have been stopped in their destructive marches across country by the dropping of poisoned bait. Once the pests get out of control, the airplane (*Continued on page* 62)

Stearmans converted to agricultural use spray and dust crops for Marsh Aviation Co., Phoenix, Ariz., one of largest commercial companies. Plane conversions must be approved by CAA.

It takes more than an airplane and pilot to be a success in the crop-dusting business

Lights for the Private Strip



Three fundamentals for an airstrip lighting system are a 10-watt bulb, weather-proof socket, 18-gauge double-conductor rubber-covered wire.

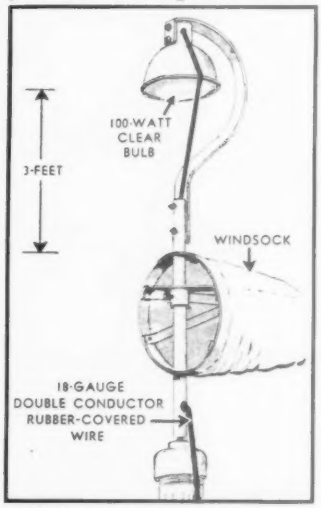
Basic unit is supported by heavy gauge wire fastened to wood stake or to runway markers.

Landing lights for a 1,500-foot strip can cost less than $200.

By HAROLD D. WEATHERLY

OUT of the night came the purr of a small plane, winging straight for the farmstead. In the house, the farmer's wife heard the engine and walked to an electric switch marked "field lights." She flicked the switch, and a twin row of lights defined a landing strip on the black ground below the plane.

The farmer, who had been delayed until after dark, circled the house and landed on the strip. He parked the plane in a T-hangar, walked toward his barn and started his night chores.



Wind sock is illuminated by overhead light. Wire runs through pipe.

This night landing on his own lighted strip was routine for him but his experience was unusual in one respect: few private fields have lighting facilities, even though it is possible to light a 1,500-foot strip for less than $200.

Most equipment provided commercially for airfield lighting is too expensive for the private airstrip owner. These commercial lights are manufactured to CAA standards to insure dependability and high visibility under adverse conditions. But most private owners don't require lights which are extremely powerful. And they don't need lights which will work efficiently under marginal weather conditions because they are grounded at those times anyway.

The primary desire of the strip owner is that his field be defined by lights. It is possible for a pilot to install such lighting at a cost of between 10 and 20 cents per lineal foot.

There are five basic units for the set I describe. The first unit is an 18-gauge (or larger) two-conductor rubber or neoprene covered wire similar to that used on a trouble light. This wire retails for approximately six cents a foot.

The second unit is a standard weatherproof socket with a standard 10-watt clear 110-volt bulb. These sockets retail for 25 to 35 cents and the bulbs cost about 20 cents.

Persons who want a more elaborate installation can use a standard vaporproof-dustproof fixture having a metal or plastic base for the bulb and a glass cover to protect the bulb from the weather. Some types have a wide mouth fruit jar for this cover. This fixture may be fitted on a pipe to hold it upright.

The third unit is a heavy gauge wire used to support the light about 18 inches above the ground. The wire can be fastened to the runway markers to hold it in an upright position.

The fourth unit consists of two eight- or 10-gauge single conductor wires which will be used for a pole-supported line to connect the runway lights to a point as close to the electric meter as possible.

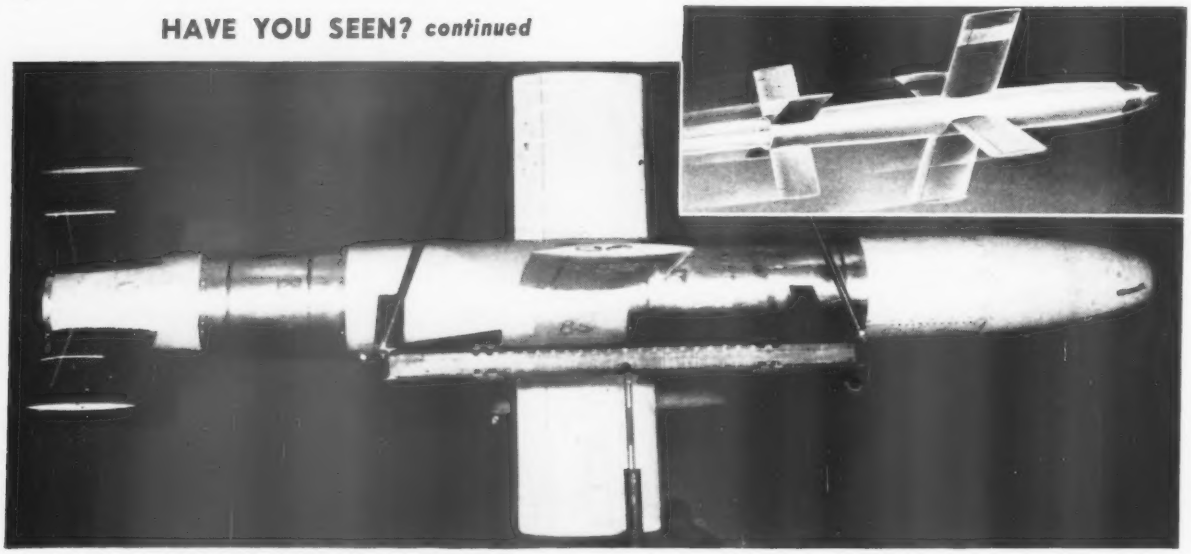
The fifth unit is a fused and grounded switch box which should be placed in the circuit between the meter and the runway to facilitate turning the (*Continued on page* 74)

Republic XF-91, (top and right) is a radical new Air Force interceptor powered by single GE J-47 turbojet developing nearly 6,000 lbs. thrust with water injection. Note inverse taper.

HAVE YOU SEEN?

Convair Model 7002 (right) is designed to test stability and control characteristics of Delta wing. With 60° sweepback, the triangular wing has elevons in trailing edge. It is powered by an Allison J-33 turbojet.

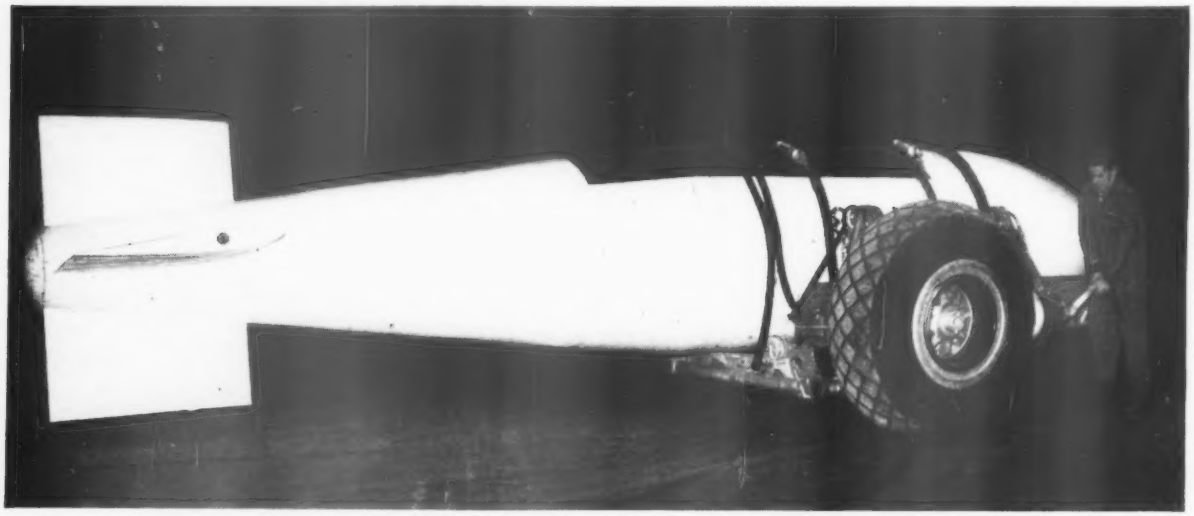
HAVE YOU SEEN? *continued*



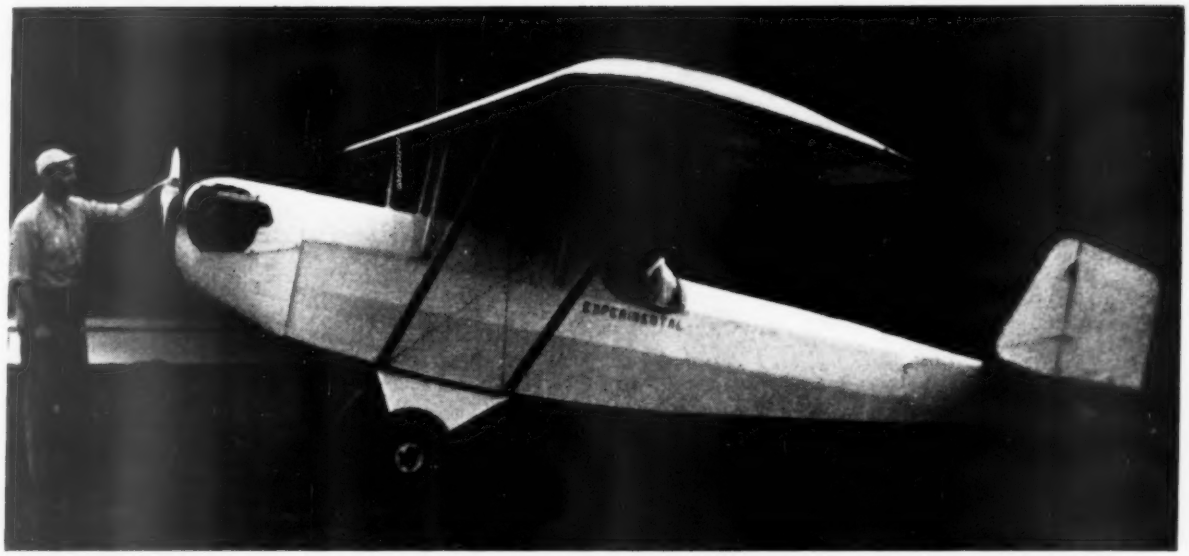
Rocket-powered guided missile, the Fairchild Lark is a Navy ship-to-air weapon. The missile, officially designated XSAM-N-2, now is undergoing tests at Naval Air Missile Test Center, Point Mugu, Calif. Artist's conception (inset) shows it in flight.

Giant French airliner, Aerosudest SE-2010 seats 160 persons. The big plane, still in testing stage, cruises at 272 m.p.h.

Aerosudest SE-1010, an all-metal French high-altitude photo survey plane, cruises at 335 m.p.h., has range of 4,536 miles.

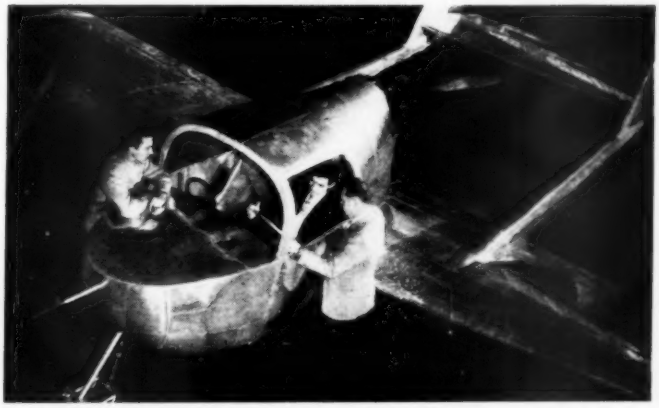


World's biggest bomb, the 42,000-pound Grand Slam, is loaded into B-36 prior to high-altitude simulated bombing mission. A B-36 recently carried two of the 21-ton bombs from Fort Worth to Muroc, Calif. This was the biggest bombload ever carried by any airplane.



Flivver plane with 60-h.p. Franklin engine was built by Bernie Pietenpol of Cherry Grove, Minn., at estimated cost of $500. Craft has 29-foot wingspan, top speed of over 100 m.p.h., stalling speed "under 30 m.p.h." Licensed experimentally, the plane is a two-placer.

Cusick Special, high speed glider for air show work, has 14-foot span and an empty weight of 305 pounds.



Two-place 'dream' plane was designed by Northrop Aeronautical Institute students. Now in the mockup stage, it is expected to fly in 1950.

Experimental amphibian, Colonial Clipper XC-1, cruises at 105 m.p.h. on 115-h.p. Lycoming engine. A two-three placer, it is built by Colonial Aircraft Corp., Huntington Station, L.I., N.Y. Company plans to begin production within four months. Tentative price: $8,750.

I Learned About Flying From That! NO. 114

By ROBERT L. PERRY

Lucky pilot Bob Perry leans on Cub which vaulted stone fences on take-off and landing. Perry ran out of paper when he started to compile lists of mistakes he made on day of fateful hop.

Plane Vaults Fence in Landing; Firemen to Aid in Takeoff Today

If getting in was a problem for Pilot Robert L. Perry—and it was—getting out should set a new high in emergency takeoffs.

Perry, flying a light private plane from Chepachet to Groton, Conn., yesterday afternoon, was forced down by fog in West Greenwich. He circled twice around a field owned by Russell Franklin off Nooseneck Hill Road, then touched down.

Unable to stop, with a stone wall looming up ahead, Perry horsed back on the stick and vaulted the light ship over the barrier into the next field. About 50 motorists ... to watch his steeplechase ... load of ex-Army ...

the field is too short for a normal takeoff. He called, as people with a problem will, on the West Greenwich Fire Department.

They agreed to detail fi... men to report to the field a... today. "The heavy-handed f... will hang onto the tail of the... Perry will rev up the engin... Perry figures he's got ... power, all hands will let g... ship will take off ... they all hope.

"I will return ...

The landing field was perfect except for three stone walls.

THE SKY was overcast with some scud around 1,500 feet as I walked toward the flight line at Trumbull Airport, Groton, Conn. Visibility was about four miles, but I knew the sky could close in tight at a few moment's notice.

Even so, it was a warm March Sunday, the little yellow *Cub* was waiting there on the line, and I planned only to fly around the pattern and practice area.

The Continental engine purred sweetly as the *Cub* climbed out of the field, and the air was quiet and still—without a hint of rough weather. At 800 feet, I cleared the pattern and headed north toward one of my favorite practice areas.

Then the idea came to me. Why not fly up to Chepachet, R. I., where my boss lived? It was only about 60 miles and he had asked me when I was going to fly up to the farm. It would be a nice ride—with a tailwind on the way up and a headwind coming back. That wind business (a 35 m.p.h. south wind) wasn't too good but it didn't bother me at the time. I shrugged off the fact that most of the country up there was forest and lake—and sparsely populated.

I knew the route like a book, and decided it would be useless to drop back to the airport for a chart. I altered my course to follow Route 80 which looked like a ribbon of toothpaste squeezed out over the countryside. Visibility still remained three or four miles and I didn't have any trouble following the concrete compass.

In about 45 minutes I picked out the boss' house and farm buildings on a high rise overlooking the valley. When I jazzed the throttle and wiggled the wings he and the family came out of the house. As I circled the area, I noticed low flying scud coming in at about 800 feet from the south—and realized that bad weather had been following me up the coast. A quick look convinced me that there were no obvious spots to set her down, and that it would take a lot of looking to find an emergency field. I knew, however, that I should land as soon as possible.

I tried dragging a few farm fields but each had something wrong with it. In one the wind wasn't right, in another the approach brought me too close to wires, and so on. After wasting precious minutes, I decided to try for a larger field that I knew was at the junction of Highways 102 and 3. This meant flying eight miles back the way I came and also back toward the bad weather, but I still had time before the ceiling and visibility would close down to zero. Because of the headwind, it took me about 20 minutes to cover the eight miles. When I did arrive at the junction of the two highways I discovered the field had been plowed for the spring planting, and a wall and wire fences had been put up!

I was in a spot and a bad one at that. Ceiling was something around 700 feet and visibility about one mile and closing in all the time. To the south it was black, that ominous black that spells hard rain. Behind me it wasn't much better. It seemed as if the (*Continued on page* 64)

A page of service tips for private flyers and fixed-base operators

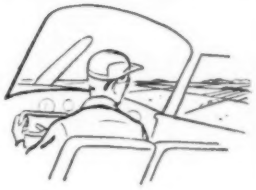
PLANE FAX

Avoid engine failure during take-off

Proper warm-up is a "must" for safe take-off. Don't take chances on a cold engine that doesn't "rev up" on the ground. Engines warm up faster with Chevron Aviation Gasoline without vapor-lock. That's because this premium-quality fuel is scientifically blended with just the right amount of light fractions for extra power and peak performance under all conditions.

Four quick do's and don'ts in case your engine conks out during take-off.

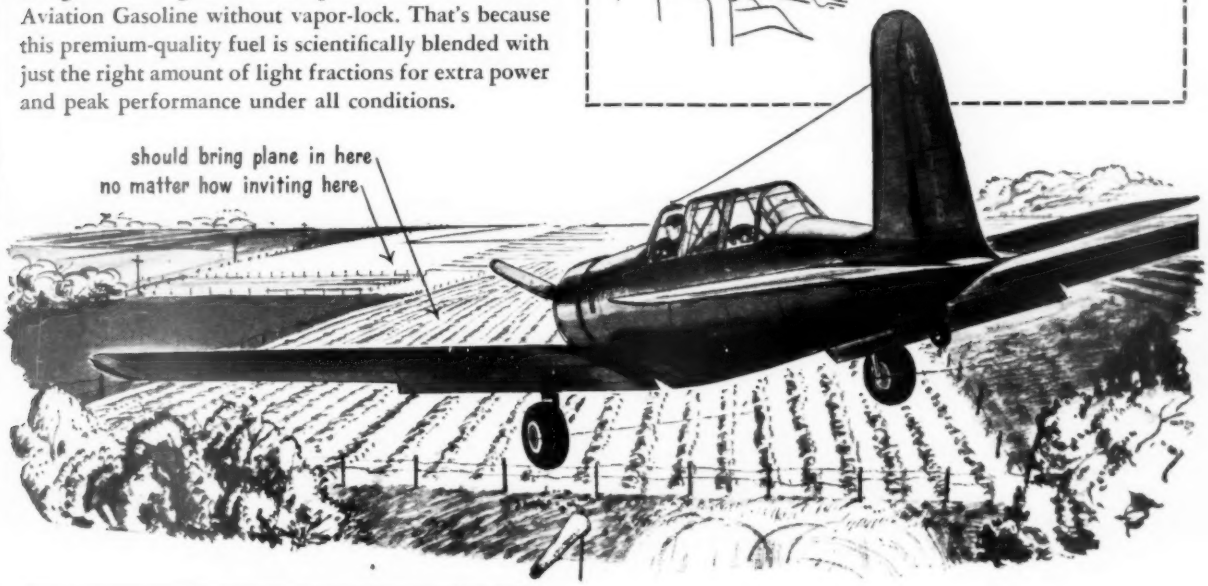
① Pick a spot—fast—for a forced landing



② Get the nose down

③ Don't bank sharply

④ Don't stretch the glide



Compute fuel consumption with your flight indicator

You're welcome to this free speed and distance calculator

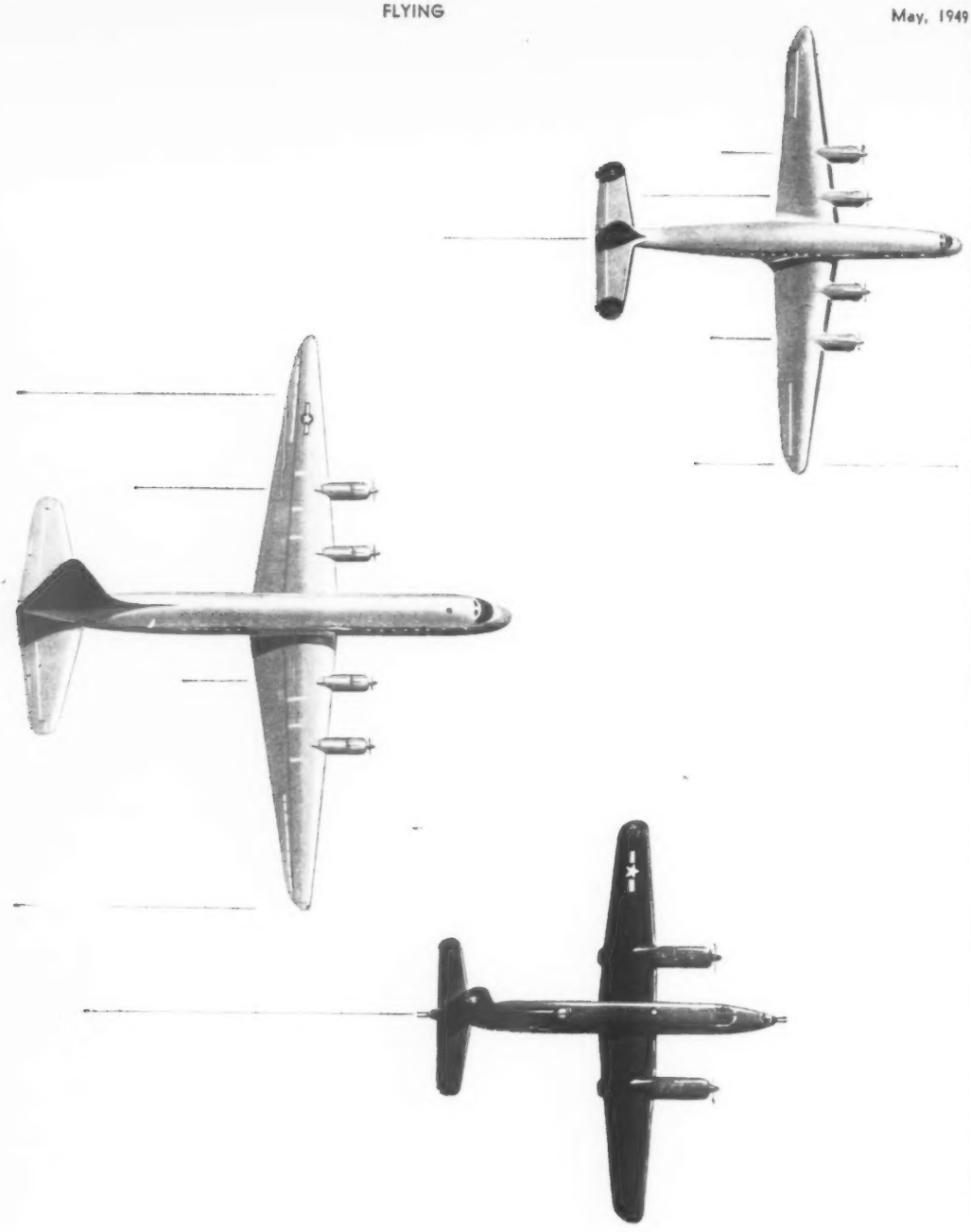
Your handy little flight calculator helps you work fuel-consumption problems as you work time, speed and distance problems. Simply substitute gallons for miles, and gallons-per-hour for miles-per-hour. If you haven't received your calculator yet, drop in to your Standard Airport Dealer for your free copy soon.

"We take better care of your plane"

CHEVRON AVIATION GASOLINE

RPM AVIATION OIL

Standard Oil Company of California



All the Leaders are Lockheeds

Sales Plane

(*Continued from page* 39)

camp, takes off from the meadow or clearing in pine timber and flies the 45 to 70 miles where he is working. Around 11 a.m., he takes off again to escape the mid-day heat, often carrying a prospect with him, and returns to camp to loaf in the pines until 3:30. He then returns to the valley, working until dusk and making camp with just enough light to land by. With hotels costing $5 a night and meals $3 minimum, he saves a tidy piece of change every day.

Although Arnold thinks the *Call-Air* has very neat lines, pilots accustomed to more conventional designs call it "gawky" at first sight. This has led to a rather surprising source of increased revenue for its owner. Prejudice over the *Call-Air's* looks leads men to back their ignorance with cash. Ken carries a brand new $50 bill for bait at all times. He calls it his "bettin' money." When Arnold lands at some fields, the operators run out, warning the local yokels, "Don't bet with this guy on anything about that plane."

At Chehallis, Wash., a witty character bet $50 against Ken's claim that the ship would "get off in about 100 feet."

The plane was empty, with only three gallons of gas in its tanks. Two lines were marked 100 feet apart and witnesses lined the runway. Arnold wheeled the ship into power at right angles to the "strip" and kicked it around for take off with power fully on and rolling. It was early in the morning, moderately cool, and the wind was given as 5 m.p.h. by the weather station. The take-off measured exactly 49 ft. 8 in.! Year in and year out, Ken averages about a buck a day on other people's mistaken ideas about the unusual-appearing *Call-Air*.

The plane has remarkable forward visibility at high angles of attack. He throttles back to 40 indicated, stays close to a familiar road and doesn't hesitate to land anywhere. He has been accused of "crazy flying" but thinks that people simply don't know the *Call-Air* or they wouldn't say that. He feels that his ability is average and that he is essentially conservative. Where he is different from the average pilot, however, is that he spent hundreds of hours learning slow flight techniques and power approaches to landing. He also knows how to get a ship off in the shortest space possible, something most pilots don't know, in spite of their own opinions. There are tricks to all trades and using calf pastures for airports has a few tricks of its own that are not universally known.

One of the 50 plowed fields Arnold has used for airstrips led to the only major damage his ship has suffered. It had been disked and harrowed and he landed "across the furrow" and nosed up, damaging the prop. He decided to move the ship a mile or so down a canyon highway to an air strip. Suddenly a car came around a bend and plowed directly into one wing tip, knocking three feet off and smashing the windshield of the automobile. The driver escaped the flying glass.

When Ken asked what the driver thought he was doing, the man answered: "Hell, airplanes don't use this highway. I thought I was seeing things. I figured it would go away!" It cost Arnold $350.

On a recent trip to the northwest, Ken landed on a sand spit of Victoria Island where a land plane had never ventured before. Salmon fishing was the lure, and he stayed seven days. In addition to the plane load of quick-frozen salmon he carried home in dry ice, he canned eight cases of the finest salmon meat and had it shipped to Boise.

Thus the airplane pays for itself in other ways, too. Arnold gets his beef at cost, often helping butcher it on a stock ranch. He once received a six-month supply of meat for helping round up some horses on a one-day flight in the Oregon-Nevada badlands. The meat was beef, not horse.

He always spots the best goose congregations flying around his region of action and gets 20 or so every season. He also gets to hunt big game now whereas he never had time before.

In the winter he couples a pair of *Call-Air* skis over his wheels like a pair of overshoes and continues visiting isolated ranches that are snowed in four and five months each year. If Boise is dry, he flies into the foothills until he reaches snow. There he lands on an open ridge, puts the skis on, and heads toward the tall timber and deep snow.

When the weather is stinko, he sits it out calmly, happy that he doesn't have to drive a heavy car over icy highways under dangerous conditions.

Ken Arnold is the man who first reported seeing the phenomena popularly called flying saucers. A Marine C-46 transport had been lost in the neighborhood of a Washington peak and there was a reward posted by relatives of the missing men—offering $5,000 for their discovery.

Arnold was searching the 10,000-foot level of a mammoth glacier when he saw nine of the objects that precipitated all the controversy and hokum. He reported them later at Pendleton, Ore., and all hell broke loose.

Events since then have brought him hundreds of "crank" letters and some not so cranky—and put him into hot water beyond description. But it hasn't made much difference in his business.

Ranchers in the region also have heard the explosions in the air, have seen towering pillars of smoke extend upward to infinity, and have seen the endless columns of pure light that tower as far as the eye can see at night. Hundreds of them have told Arnold about things they would not discuss with newspaper reporters or other investigators.

Nevertheless, Arnold thinks the most uncanny part of the whole thing may be the information given him by a member of the searching party, that eventually reached the wrecked C-46 Marine transport at 10,000 feet on a frozen glacier. There was not one trace of blood, or flesh, or bone of the 32 men who had been aboard when it crashed. An eerie funeral service was held at the empty wreckage and it was written off with a pat explanation that the men had probably all fallen into an ice crevasse. The $5,000 reward for discovery of the bodies has never been paid. END

All current Lockheed planes have set official world records.

The Lockheed Constitution has carried more people farther—nonstop—than any other operational transport (90 persons 2,557 miles).

The Lockheed F-80 Shooting Star set the world's official speed record for crossing the continental United States (2,445 miles in 4 hours, 13 minutes).

The Lockheed Constellation broke the official transport speed record—after four years of commercial service—by crossing the United States in 377 minutes.

The Lockheed P2V Neptune has flown a greater distance nonstop than any other plane in the world (11,236 miles—from Perth, Australia, to Columbus, Ohio).

Lockheed

AIRCRAFT CORP., BURBANK, CALIF.

Look to Lockheed for Leadership

Copyright 1949, Lockheed Aircraft Corp.

AOPA NEWS

Aircraft Owners and Pilots Association is a service organization for the private pilot or aircraft owner. AOPA's full time staff is devoted to helping the individual pilot. Its aim is: "To make flying more useful, less expensive, safer and more fun."

Headquarters are: 15th and New York Aves., Washington 5, D. C. Members also receive a special AOPA edition of FLYING, newsletters and confidential aviation data. Opinions expressed in this column are not necessarily those of FLYING MAGAZINE.

OMNI TEST PROGRAM

Omni-directional radio is to be given a thorough, exhaustive test, beginning some time in June. Ground and airborne equipment—airline, military and personal plane—will be used in the tests. An AOPA official is serving on the working committee of the test program, representing private flyers.

Present plans call for tests to be made at three "typical" sites: Patuxent Naval Air Station (level ground and water nearby), Phillipsburg, Pa. (convex mountainous terrain), and Salt Lake City (concave mountainous terrain).

AOPA and CAA are arranging to have as many types of personal-plane omni equipment as possible tested during the five-month program. The entire test program is under the direction of the Air Navigation Development Board.

ERCOUPE WINDSHIELD

A recent AOPA published item showing the newly-developed windshield for the 1949 Ercoupe brought so many inquiries from members that National Headquarters had to take up the question of converting the windshield of old Ercoupes to the new design.

Sanders Aviation, Inc., world-wide Ercoupe distributors, have advised AOPA that special kits will be available to members shortly, enabling them to convert to the new windshield. Approximate cost: $80.

SHOULDER STRAPS

AOPA's continuing campaign for shoulder straps for use in personal planes has resulted in at least one manufacturer now offering complete harnesses for installation in small planes.

The manufacturer is the Irving Air Chute Co., Buffalo, N. Y., famed producer of parachutes. That company now has military-style harnesses for sale to plane owners.

LANDING FEE

AOPA has added Logan airport, Boston, Mass., to its list of airports charging landing fees. The management has announced reinstatement of landing fees there, with a minimum charge of $1 for personal planes. There's a new twist to the Boston fee: it's based on take-offs instead of landings. Larger aircraft are charged for by weight—take-off weight.

WARNING

Several cases have been reported recently in which individuals in various parts of the country have collected membership fees from persons wanting to join AOPA.

All present and would-be members are warned that AOPA does not authorize any outside collectors to solicit memberships; all such transactions are handled only through National Headquarters.

TARGETS FOR SPORT?

A wave of requests has come to AOPA headquarters from members wanting to locate and buy surplus Culver target planes for use as high-speed personal planes. Because of the number of requests, AOPA investigated and finds the Culvers cannot be certificated except as experimental aircraft. AOPA also is warning members that the Culver target plane is not for "Sunday pilots."

STALL-WARNING

The special arrangement whereby AOPA members could buy Safe-Flight Instrument stall-warning indicators at a $9.60 saving ended March 31. Many lightplane manufacturers are expected to have SFI indicators on their new planes as standard equipment by summer.

FLIGHT SOUTH

Berni Dardell (AOPA 41704) has just written a report on his recent flight from San Diego to Buenos Aires, Argentina, in his new Ryan *Navion*. Member Dardell has notified AOPA that he flew a total of 8,394 miles in 16 days. He flew a total of 68 hours, averaged 123 m.p.h. and 12 gallons of fuel per hour. Though he only had 195 solo hours when he took off from San Diego, Dardell crossed the Andes Mountains during the trip (he climbed to 15,700 feet to get across). Cost of the whole trip, including fuel and hotel bills, came to $300.

TRAFFIC PATTERNS

In case other private flyers are interested, here's the information AOPA dug up for a member recently:

If you're in doubt about the proper altitudes for a traffic pattern at a strange airport, fly over the field at 1,500 feet, watch what the home-based planes are doing, then descend to their altitude and enter the pattern with them. Each field's traffic pattern is individually approved by CAA, so you should conform to it.

NEW HANDBOOK

The new Aircraft Powerplant Handbook written by the CAA has been placed on sale at the Superintendent of Documents, Washington, D. C. The price is $1.25.

This CAA technical Manual No. 107 is a revision of the Civil Aeronautics Bulletin No. 28 (Pilots Powerplant Manual), which was a textbook for the several hundred thousand pilots trained by the CAA in the Civil Pilot Training Program before and during the war. The new edition, however, is a more comprehensive book, with virtually every part revised and material included on the latest types of powerplants, including turbo-jets, turbo-props, and compound engines.

Many chapters of Bulletin 28 have been rewritten extensively in the light of research developments. END

Culver target planes can be certificated only as experimental aircraft. AOPA warns they are not for "Sunday pilots." (See item.)

Dependable

CHAMPION

America's Favorite Spark Plug

C26—
Unshielded
Actual Size 2⅜"

R 37 S-1
Actual Size
Shielded Type

HERITAGE

Champion Ceramic Aircraft Spark Plugs are not only products of specialization, but also beneficiaries of the richest heritage in the spark plug field. Champion produces spark plugs exclusively and has attained leadership because every single Champion Spark Plug—aircraft, automotive or otherwise—is backed by unequalled research, engineering, manufacturing facilities and EXPERIENCE THAT HAS NO PARALLEL. Champion Spark Plug Company, Toledo 1, Ohio.

Listen to the CHAMPION ROLL CALL... Harry Wismer's fast sportscast every Friday night, over the ABC Network

USE CHAMPIONS
AND FLY WITH CONFIDENCE

LOGGING TIME

WITH HY SHERIDAN

Captain, American Airlines

DO YOU KNOW WHAT YOU REALLY ARE?

The use of radioactive isotopes as physiological tracers has its discouraging aspects, especially to a man of ego like me. The tracers show that atoms are continually coming into a man's body, sitting down for varying but short periods, and then going on their way.

Any part of you was perhaps not there yesterday and may not be there tomorrow. There seems to be more than a little scientific truth in the old figure of speech that a man is what he eats. He is, but not for long. Atoms come and atoms go, like molecules of water going through a whirlpool where nothing lasts except the shape.

And so, dear reader, you are not a person, an individual. You are merely a place.

* * *

WHAT WE LEARN AT M.I.T.

"You know what the generator said to the motor?"

"No."

"I've got some ergs, let's dyne."

"As the fuse said, I'm going to blow!"

* * *

THE RISING GENERATION

Did you ever meet up with standing waves? They are mighty interesting to study and pretty important in electrical science and so on, and in the field of supersonic flight, too. If you would like to see some all you have to do is fly on an airliner and fill a washbowl with water or set a cup of coffee down on a table, and the surface of the liquid will get corrugated, which is caused by the vibration.

A few days ago on your reporter's DC-6, a little girl was sitting with her mother. The stewardess had brought the child a cup of hot chocolate which she set down on the individual table.

"Mom," the little girl complained, "my chocolate's cold already."

"Oh, it can't be."

"Well, it's got goose-flesh."

* * *

WHAT THE SAFETY RECORD MEANS

Airline officials are getting sore elbows patting themselves on the back over the safety record of the late winter. The record was indeed good. We must understand why it was good because, as history shows us, there is nothing so dangerous as a good safety record. The first thing that some people think of doing is to chisel on safety standards, requirements and limitations.

Now that a bill has been introduced in Congress to recreate the Independent Air Safety Board, a general understanding is vital, for the opponents of the proposed board are already saying that we don't need it, and that the old system of having the people who cause the accidents investigate themselves is proven sound.

An Egyptian columnist writing somewhere around 3,000 B.C. said that whatever man plans for never comes to pass—a plaintive thought that the airlines are echoing today. After the war, airline managers, a bit high on the toddy of priorities, planned for passengers who just about overwhelmed them with their absence. So the bosses had to cut down. They kicked out so many employes that they had to get copper-toed shoes.

No new captains are flying airliners today. The lowly co-pilot is almost always a four-striper, a demoted captain. The mechanic who is lowest on the seniority list was probably working on *Jennies*.

The traffic is so light that enough gasoline can be put on the airliner actually to get the pilot where he thinks he's going. Empty aircraft sit on the ground long enough to get worked on; and so many of them are out of service that parts are often available to replace parts that have failed. The captain can fly along the airways without being an artist in broken-field running.

Everything is being run by veterans today. That is why the safety record is good. That is the only reason.

* * *

HERE HE LIES, AS USUAL

Well, your reporter missed his deadline for Logging Time for the April issue, and the editor had to go into his waste-basket for the spoor of wild thoughts that had slinked by before. "Sure poor spoor," he remarked.

Nothing will get an editor pulling his ear lobes like having his writers miss their deadlines. Editors and grizzlies get bitter when not fed in time. Accordingly the M.E. (managing editor to readers) supplied the epitaph for this month.

Here lies Hy Sheridan, humor unfused,
A writer, but one of inaction;
Oh, never, I swear, did he meet a deadline,
Save this one, to my satisfaction.

Eternity

(*Continued from page* 33)

and I had a quick vision of what would happen: We were lurching along at 60 m.p.h. . . . then 65 . . . and faster. The last few feet of the runway would be coming up soon, and I'd either have to chop those throttles right away or there wouldn't be time left to do anything except pray.

I couldn't figure it out, though I was trying to remember in those quick seconds everything that could possibly be wrong. All I knew was that the darned plane shouldn't take off at that point—and yet it was tugging and pulling to get off the ground. We were still accelerating, and the remaining feet of the runway looked like only inches.

Then, off she roared. I couldn't hold her down any longer. As the plane lumbered off the runway, it seemed to stagger. Desperately, I whipped a look around the cockpit. Maybe the trim was off. I thought of a thousand things, discarded them. I caught a glance at my co-pilot, who about that time looked like a lad walking the Last Mile.

And then we both looked down and at the same instant saw what had happened.

I had left full flaps on the plane!

That spanking new co-pilot worked like a high-speed machine. His arm shot down, and he dumped the flaps in a fraction of a second.

There's no need to tell pilots what happens when you dump the flaps—especially with a heavily-loaded plane the size of the *Commando*.

Ordinarily, the flaps would have been set at 15° because any setting beyond that acts as a drag and cuts down forward acceleration. Taking off with full flaps, we became airborne faster (the tail just wouldn't stay down) but forward acceleration was slowed almost to the stalling point.

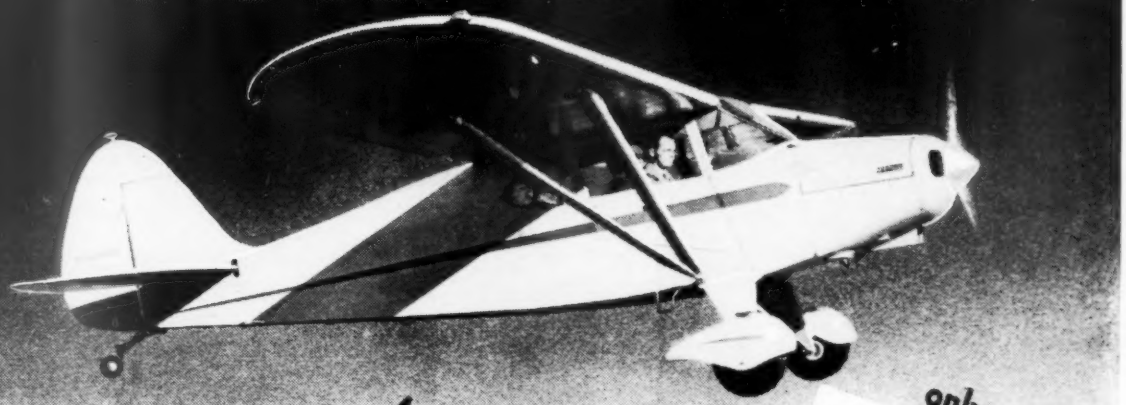
So there we were. The co-pilot had dumped the flaps. He knew what would happen then, and so did I. I felt like I was piloting a big hunk of lead. We lost altitude—I don't know how much. I was too busy gunning the plane at full throttle and rolling forward with all my might on the trim tab to keep from stalling. The co-pilot realized better than I that we were about one foot from eternity.

My gear was up by this time, and we were still so low that the prop tips were missing the ground by inches. The red lights at the end of the runway were getting big as cannon balls—and right behind them was a hill. Even at that moment, while I was breaking out in a cold nervous sweat, I thought mirthlessly about the headlines back home: "Tyrone Power's Last Scene—A Smash Hit."

But, almost miraculously, we squeezed over that hill with the old *Commando's* engines screaming. The rest of the ride to Okinawa was anti-climax. But today, whether I'm flying a plane in California or in Rome, I sit for a second or two before take-off and remember that day on Saipan. It helps me remember that I've got a lot to learn—and that in flying, you can't afford to do any forgetting. END

America's Greatest Plane Value

PIPER CLIPPER



A Complete 4 place Plane

only **$2995** F.A.F. Lock Haven, Penna. (Standard Model)

Never in the history of aviation has so much been offered for so little. Piper, always the leader in low-cost practical aircraft, has done it again with the sensational new 4-place Piper Clipper—priced at only $2995.

Here's a brand-new airplane with remarkable performance and lots of roomy comfort—backed by Piper's 18 years of leadership in the light plane field.

Just think of it! Here's a 4-place airplane with 112 mph cruise, 480 mile range, powered with the famous Lycoming 115 horsepower engine. That's a whale of a lot of airplane for less than $3000.

But the performance is even better than the price. Top speed is 125 mph, full-load rate of climb is 600 feet per minute (over 1200 FPM solo). You've probably never flown a plane with as much get-up and get-out."

You'll get a new idea of aircraft values, a new idea of personal plane performance—see your nearest Piper dealer for a demonstration.

For illustrated brochure, write Piper Aircraft Corp., Lock Haven, Penna., Dept. 5-FL.

DESIGNED FOR PRACTICAL UTILITY

CARGO SPACE

Rear seat is quickly removable for freight. Large rear door makes loading easy. 36 cubic feet capacity.

PLENTY OF ROOM

There's plenty of room in the Clipper. Front seat is adjustable for added comfort.

115 HORSEPOWER

"Round-the-world" Lycoming with new Piper cross-over exhaust for extra take-off power, has starter, generator as standard.

PIPER AIRCRAFT CORP.

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Trainer, Sprayer

PIPER PA-15, PA-17
65 hp Vagabond

PIPER PA-14
Family Cruiser

PIPER STINSON
Station Wagon

The Wind and You

(*Continued from page 32*)

sailplane 75 feet into the air! Bob's airmanship, sharpened by soaring training, saved the day. He got that stick forward, picked up speed, and made a second good landing. The thermal was so strong that it buckled the glider's metal seats, stressed to take 10 Gs. (Sailplanes usually have higher design factors than power craft.)

A BT landing with its tail way down under such conditions would have been booted up like a football. Granted, these conditions occur only once in a great while but it takes only once to fall into such a trap. Moral: slow landings, nose high, are much more dangerous than wheel landings when strong thermals are around. And strong thermals can be found almost anywhere at one time or another, even in winter. They are, of course, prevalent on hot afternoons and in desert, plain, and mountain country.

Glider pilots go mad with joy if given an opportunity to take off just ahead of a wicked storm front. They are assured of exhilarating altitudes and adventure galore. Power pilots, wise in this respect, leave fronts alone if possible. Nevertheless, every pilot may sometime be forced to fly into or out of a field under the looming darkness of a front. That's when every pilot should beware. The wind shifts with a bang! It can swap directions 180° in a few seconds. You can be taking off into a 20 m.p.h. wind, and after a 200-foot roll you can be going 15 m.p.h. across the ground. That would make your airspeed 35 m.p.h. Then, after rolling another 500 feet, you can be moving along at 55 m.p.h. ground speed, yet still have only 35 m.p.h. airspeed. Why? The wind can shift 180°. That's bad when making a landing in any airplane. You may approach at 60 m.p.h. airspeed and 40 m.p.h. ground speed. Comes the wind shift and there you are, still doing 40 m.p.h. across the ground, but only 20 m.p.h. through the air. And that isn't enough! Don't forget, though, that thermals cause wind shifts too, and with less warning. Even worse, a thermal can hit one wing more severely than the other. Then you fall off on a wing.

Recently I was flying to Daggett, Calif., in my BT-13 tow-plane to retrieve a glider. The air was unstable and the sky was filled with cumulus clouds. I called Daggett radio for landing instruction and noted a thunder shower about one mile south of the field. Daggett radio told me to land on Runway Seven, and said the wind was NE 9 m.p.h. Realizing that I might encounter severe downdrafts or a possible windshift on the edge of the thunderstorm (the big cumulo-nimbus cloud at that time covered the entire area and was moving toward us), I lowered my flaps 30° and made my approach at 100 to 105 m.p.h., 10 to 15 m.p.h. faster than normal. (The BT stalls just under 65 m.p.h. without power, and can be "mushed" just under 60 m.p.h. with power.) The flap placard maximum was 111 m.p.h., so I didn't want to glide any faster because of the possiblity of severe gusts. Just as I anticipated, about 200 feet above the field the airspeed dropped alarmingly and I felt the bottom drop out. I pushed the throttle wide open and nosed down as much as I dared, flaring out just in time to make a wheel landing at 70 m.p.h.! What happened? The CAA weather and communication station said they recorded the wind change just as I crossed the field boundary—a change from 7 m.p.h. NE to 30 m.p.h. W! That's a difference of 37 m.p.h. in a matter of seconds, not to mention the accompanying downdrafts. Had I been making a standard approach at 85 to 90 m.p.h. with throttle partially retarded, the results could have been serious, since airspeed would have been changed with very little warning from 85-90 m.p.h. to 50-55 m.p.h. At such a low altitude, it is doubtful that we could have recovered in time. As it was, our flare-out had to be made abruptly. Someone asked me if a stall warning device might not have warned me of this condition. Yes—it would have, *when it happened*, that is when the airspeed dropped—and not before. Only my experience as a soaring pilot and knowledge of the atmospheric conditions prevented a possible serious accident. First, I anticipated the possible wind reversal and downdraft; second, I increased my normal glide speed and power setting.

Another phenomenon I experienced on several occasions occurred when, inadvertently, I confused a rotating column of dust as a good up-draft. Not until entering it at about 1,000 feet did I discover it to be a downspout of air so violent as to give an indicated sink of 1,800 feet per minute. Apparently this down-spout was like an inverted thermal, with the uprising air surrounding it. As we left the down-spout, the air at the edges above the rising ring of dust was extremely turbulent and at 500 feet (we sank to this altitude just going into and out of the down-spout) we encountered immediate lift of 1,200 feet per minute over an area large enough to turn in. Then we soared to 8,000 feet above El Mirage.

A brief review of the aims and main points of this article:

First, we're not concerned with ordinary wind conditions. We *are* concerned with the booby-trap type. Most flyers fail to understand the prevalence of potentially dangerous wind conditions.

Second, devices such as stall-warning indicators can be extremely valuable. They tell when your angle of attack is getting high, or airspeed is getting low. But one should not feel encased in impervious armor if he has such a device. At times your airspeed will drop off in a twinkling because of atmospheric conditions.

Third, atmospheric quirks at *low altitudes* can result in damage to planes if pilots are not alert:

(1) Hitting strong thermals head-on is annoying. Prepare your plane for this contingency by flying faster and with more power during let-down. Wheel landings that reduce your angle of attack are a sensible precaution on boisterous days.

(2) Down currents can extend right down to the carpet. There is not always a "cushion" high enough to allow recovery. Your best move is to dive, add power, turn around, and get out of there fast—with sufficient flying speed.

(3) Hitting a strong thermal a glancing blow will rock your plane badly. At worst, it will create a dangerous wind shift and leave you stalled-out.

(4) Rolls can cause freak gusts with or without thermals. Pilots should carry both speed and power.

(5) The lee of hills and mountains, plus heat from the sun, will churn air violently. If conditions look bad, go away; or at least make another pass with more speed.

(6) Wind shifts caused by passage of a front are dangerous. The drop you feel may be caused by a gust hitting from behind. Or, the bump you feel

15 YEARS AGO

FROM the May, 1934, issue of this magazine:

Maj. Gen. Benjamin Foulois, Chief of the U. S. Army Air Corps who flew his own plane (O-38-F), took pride in the fact that "nobody could say he was a chauffered general."

Amelia Earhart designed women's sportswear which was featured coast-to-coast in leading department stores.

The Sikorsky S-42 (see photo), on order by Pan American Airways for transoceanic service, was ready for

delivery. Designed to carry 32 passengers, a crew of five, and a half ton of mail, the S-42 had a 1,200-mile range. Cruising speed was 150 m.p.h.

An advertisement of the U. S. Aviation Supply Company offered a leather helmet, snugfit goggles, logbook, fountain pen and pencil, identification tag and lapel wings ("Worn by all aviators—a symbol of respect") all for $7.50.

U. S. airlines employed 543 pilots, 206 copilots, 2,320 mechanics and ground crew men, 1,834 other hangar and field personnel, 1,370 operation and office personnel.

Air program for 1934 called for 1,184 new planes and engines amounting to $90,000,000 for the Navy, and 1,150 new planes and engines costing $45,000,000 for the Army.

Sign of the Times. This advertisement appeared in the classified section: "Will trade for lightplane, practically new Ideal Lawnmower Sharpener . . ."

TWENTY YEARS AGO

"In the past," declared an author, "we have thought too much of the airplane as an instrument of war. Now we have come to look upon it as a messenger of good will."

CITIES SERVICE

The most thrilling airview in the world—Greater Manhattan—is only one of the fine services offered by the Cater-White Seaplane Base located at Hudson River and Dyckman Street. This ideally situated seaplane base is alertly managed and fully equipped. In addition to the vastly popular aerial sightseeing trips, the Cater-White Seaplane Base offers charter service, student instruction, hangar space and, of course, a complete line of top quality Cities Service aviation products.

If you are like most flying enthusiasts, who consider an airview the greatest thrill in traveling, then plan to stop at the Cater-White Seaplane Base on your next trip to Manhattan.

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FLAT SPINS

FLYING PARROT CUSSES CUSTOMS

•

DUCK THAT FORGOT TO DUCK

•

A MIGHTY LOW WAY TO MAKE LOVE

• NOT SO DUCKY

In Alberta, Canada, Leon D. Cool had to make a forced landing in a swamp when the engine of his Stinson L-5

conked out. Reason: he was rammed by a duck. His job: counting ducks for the Fish and Wildlife Service.

• HOW LOW CAN YOU GET?

A farmer in Lincoln, Neb., filed suit for $25,000 against an aviator. The charge: the pilot was alienating the affections of the farmer's wife by buzzing their home.

At Pensacola, Fla., officers are compiling a 5,000-word vocabulary of easily understood words. Navy men will use the vocabulary when surrounded by noises of combat planes.

• PILOTS WITH CONVICTIONS

Australia hopes the wild blue yonder will eliminate unlawful notions. Its Air Force no longer rejects flying candidates because of police records.

• MIGHTY BIG REDUCTION

In Frankfort, Ind., Dr. Isaac E. Michael took his private pilot certificate to a photo shop to be photostated. "Reduce it to 2x3 inches," he said, "so I can put it in my wallet." A week later he picked the photostat up, had a hard time carrying it home. The job was perfect except for one thing: the photographer had made it 2x3—**feet!**

• IT SHOULDN'T HAPPEN TO A MINK

In Independence, Mo., two flyers were sued for "buzzing minks." Farmer Vivian Marble claimed their low-flying tactics scared 142 baby minks to death and frightened their mamas out of the breeding habit. Claimed damages: $4,040.

• IT HAD TO FLY, TOO

When the Army finally decided to buy a plane back in 1907, their requirements were tough. Specifications stipulated the craft must have a top speed of 36 m.p.h., a pay load of two passengers, ability to stay in the air for an hour and to carry enough fuel for a 125-mile non-stop flight. Furthermore, it had to be "simple enough" to be started in an hour.

• JUST A LITTLE BLOCKADE

Shortly after reporting for duty, a fledgling pilot on the Berlin Airlift asked:

"Can I fly into Berlin on a pass or leave some day?"

"No," answered the briefing officer.

"Well—okay," persisted the flyer, "but can y'give me a copy of the Berlin train schedule?"

"Poor guy," the briefing officer commented later, "he knows everything except **why** he's here."

• PAGE MR. TRUMAN!

A parrot flying by American Airlines Flagship from Mexico City to San Antonio was reportedly refused admission to the U.S. because it used profane language.

• MAH BUDDY

Seagulls at Australia's Rose Bay flying boat base are smart. Though there's almost no visible difference between Sandringham and Hythe flying boats at the base, the gulls take off with glad cries to meet each Sandringham that approaches the field. The reason: Maintenance men of the Sandringhams toss scraps of food to the birds.

• DIDJA KNOW?

A plane flying from New York to London is more than one-third of its way to destination before it loses sight of the Newfoundland coast.

• BULL SESSION

There's good news tonight. When a bull wandered into a California Poly-

technic School landing strip and practiced goring an airplane, the owner was awarded $218 damages.

—Harold Helfer

may be from an increase in air speed caused by hitting a gust.

With a basic knowledge of the air mass in which you fly you should be able to cope with most atmospheric conditions. You could probably do as I did on a recent trip in a BT to Bishop, Calif.

Flying in stable air, the "out" trip showed little saving in fuel. Because of full load the fuel consumption averaged 24 gallons per hour at 25 inches manifold pressure (average). Arriving at Bishop, we picked up a passenger and flew over the High Sierras at 14,500 feet, using thermals and slope winds to aid the BT. The rate of climb at times showed 2,000 feet per minute with 23 inches manifold pressure! After an hour and a half, we landed. We then waited for several gliders to take off, and decided to see how high they were climbing. We used the same technique of thermal-flying the BT at reduced throttle and manifold pressure until our altimeter again showed over 14,000 feet.

After watching and photographing Bob Symons in his Pratt-Reed sailplane at this altitude, we started for El Mirage Field, which was approximately 200 miles to the south. Riding the White Mountain Range thermals and slope currents, we arrived over the lower end of Owens Lake at about 12,000 feet. We had kept the BT flying on approximately one-third throttle and thermals! We then crossed the Owens Valley to a point where we encountered a "wave" condition, generally prevalent in this area, and followed the uprising westerly winds blowing over the High Sierras and rebounding in the Owens Valley. As we had anticipated, a condition common to this area of the Mojave desert was occurring. Glider pilots have nicknamed it the "Smog Front"—and it is caused by the marine air flowing into the desert, generally late in the afternoon. This air mass is cold and pushes the warm desert air up and over it. Glider pilots have soared on this "Smog Front" to over 13,500 feet, and we had an excellent opportunity to put its energy to work.

Turning toward El Mirage, we encountered the front over Rosamond Dry Lake and retarded the throttle until the manifold pressure read only 15 inches. The BT screamed for home. At times, the airspeed reached 140 m.p.h. and the rate of climb as high 500 feet per minute. It was necessary to throttle the engine completely—and we crossed the field at 150 m.p.h. at 4,000 feet. We had left the Sierra "wave" 45 miles away with 8,000 feet of altitude. Under strictly gliding conditions (the engine was not helping us except to reduce the drag of the prop) we had achieved a gliding angle of better than 59 to 1!

Upon landing, we checked the tanks and found we had used 91 gallons in 5 hr. 35 min. of flying time. This included three landings and take-offs, one flight to 8,000 feet and two flights to over 14,000 feet. Fuel consumption was 16.3 gallons per hour; mileage flown was approximately 540!

That's one reason I say that the average pilot who applies his basic knowledge of atmospheric conditions will have safer, longer and more economical flying. END

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190 and 195

YES! After exhaustive AIR FORCE TESTS - then SPECIAL TESTS by ten "bush pilots" - the U. S. Air Force ordered 14 production-line Cessna 195s for rugged Alaskan work! Cessna considers it a great honor to have a standard civilian plane picked to serve with the finest Air Force on earth ... And is also proud that two of these ships are serving the U. S. National Guard!

HIGH WING DESIGN for greater stability. You ride in the shade—enjoy the scenery!

AIRLINE-TYPE ENGINES! A 300 H.P. Jacobs in the 195. A 240 H.P. Continental in the 190.

Room for 4 with lots of luggage ...5 if you're traveling light!

Cruising Speeds—Over 165 m.p.h. Range—over 700 miles.

All-metal construction throughout.

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I Flew for Israel

(*Continued from page 23*)

jump to Zatec, a small town 35 miles northwest of Prague. In Israeli code Zatec was "Zebra," the secret air base behind the Iron Curtain, the aerial arms smuggling terminal.

Ten minutes from "Zebra" we tuned in on a mobile field radio and came on in, after a rocky crossing over the Alps had put the finishing touches to the raw nerves of the pilot who had also picked up dysentery in Africa. By this time he'd had it. Cursing every plane in the world, he went on by train to Rome and sailed for home on a slow boat. We loaded up another plane, leaving our ship, the RX-131, behind for repairs, and took off for the south, refueling at Ajaccio, and then flying on to Aquir, the big air base outside of Tel Aviv which was to be my home base for $7\frac{1}{2}$ months.

We ATC men lived in luxury in the Park hotel at Tel Aviv, the same hotel used by the foreign correspondents. We weren't supposed to talk with any of them, and we didn't, but they got so nosey the big brass moved us to another inn, not quite as fancy. Still, we lived well, except that the food wasn't too good. Before every mission we would unobtrusively bring down our bags and take off for Aquir, wearing our cotton khaki trousers and shirts, the usual mid-East "uniform." Actually, we were outside of the Israeli Air Force, deliberately so, jealously hanging on to our status as civilians. Most of us in the ATC were Americans and we didn't want to run the danger of losing our citizenship. Some of the other crews were English or South African. There was one crew of handsome Swedes, who'd been flying D.P.'s out of Europe for years, and one Russian crew, our only Communists.

If the front line fighters, the Haganah, or Jewish Defense army, or the Palmach, which corresponds to commandos and were all tough well-trained volunteers, needed some air support, frequently we would be asked to bomb from our transport planes as we started the long haul to Czechoslovakia. That's when we'd load up with fragmentation bombs to be heaved through the doorway when we passed over the Egyptian lines. It was a big laugh to be called a bombardier for such a crude job but the title made a big hit with the girls in Tel Aviv—and that's what counted.

The real bombing was done by the B-17's, although sometimes the crews of the old British crates also did a bit. But B-17's gave Israel quite a thrill. They were the planes which took off secretly from Halifax, Nova Scotia, landed at the Azores, then "disappeared" at sea. Actually, they flew into Zatec and then on to Ramat David, the former British fighter base which had been enlarged by the Jews so it would take bombers. On their first mission each B-17 hit an Arab city: Cairo, Egypt; Damascus, Syria; and Amman, Trans-Jordan. On their return mechanics sprayed on a new paint job, altered the gun positions, changed the wing markings, and off they flew again to fool the Arabs into thinking that Israel had a full squadron of four-engined bombers.

In those early days the Jews only had a few fighters—ME-109's and some *Spits*—all of which had to do double duty. I remember one morning when an Egyptian C-47 came over Tel Aviv and dropped bombs on us, exactly as we used to do. It stooged around for 45 minutes until an ME-109 could get off at Aquir. The fighter shot down the Gyppo in a matter of seconds. We transport "bombers" felt sympathy for those Egyptians crashing in their poor old transport.

When the ATC acquired its *Skymaster* and other four-engined transports, they were used almost entirely to bring in boxed-up ME-109's from Zatec. Not far from the Czech airfield is a former Messerschmitt factory, now in production again, and these planes were bought from that plant. The Zatec field had also been a German jet fighter base in the closing weeks of the war and there were rumors in Israel that the air force was going to get jet jobs. Most of the pilots were boning up on jet manuals of the U. S. Air Force which were smuggled out of America, translated into foreign languages and republished. But up to the time I left Israel no jets had arrived.

More *Spitfires*, however, were coming into Israel. One flight of 15 took off from Zatec but had a tough job navigating, and some were forced down in Greece where the pilots were interned. When they brought in the next flight, three C-46's acted as guide ships, mothering the flight down the Mediterranean, doing all of the navigation, aided by an Israeli corvette which stood off Haifa to serve as a rescue vessel in case anyone had to ditch.

Most of our flights between Zatec and Tel Aviv were uneventful, except for an emergency landing we made, fully loaded with arms, at Treviso, Italy, where we were jailed for five days and interned a month, until "Jerry's" door-opening dollars got to work. At Zatec our field was well protected by Czech soldiers and often Czech army brass would drop in for a visit, or an inspection. We were all

THOSE FLYING COLES

IN KEWANEE, ILL., everybody knows the Cole brothers. "You'll find 'em out at the airport," they'll tell you, "if the boys aren't out with the new flying circus."

With 15,000 hours of experience among them, the four Coles (who operate Cole School of Flight) have organized what they believe is the only "four-brother" aerial circus in the U. S.

After appearing individually in more than 80 U.S. and Canadian air shows, the brothers decided to get into the business as a unit. They now stage a two-hour show with three Stearmans and a clipped-wing *Cub*, then top things off with a Piper J-3 landing-on-a-car stunt and a comedy act.

In front of their clipped-wing *Cub*, they are (from left to right):

MARION (4,000 hours), the youngest, who soloed on his 16th birthday, and was a Navy instructor during the war. He placed third in the World Aerobatic Championships in Miami last year.

ARNOLD (1,000 hours) started flying when he was 17, but took six years off to serve as an enlisted man in the Air Force. Previously, he was starred as a parachute jumper, but will fly during the coming season.

LESTER (4,000 hours) instructed primary and basic cadets during the war.

DUANE (6,000 hours) is the oldest of the Cole boys. He is a member of the Illinois Airport Operators Association, and heads the Cole School of Flight.

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TRAIN IN MIAMI -- AIR CAPITAL OF THE WORLD

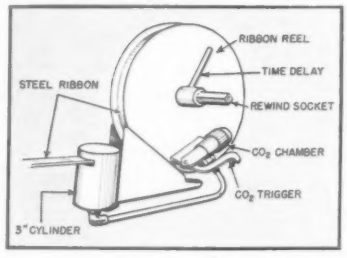
SHORT-LANDING DEVICE

LANDINGS in 45 feet have been made in a standard Piper *Cub* at Wilmington, Del. The lightplane, equipped with a new explosive "anchor" device developed by All American Airways, produced amazingly short landing runs in recent tests:

Conditions	Ground Speed	Number of Feet
Into wind	42 m.p.h.	45
Crosswind	50 m.p.h.	78
Downwind	60 m.p.h.	106
Downwind	72 m.p.h.	122

The anchor is attached to the end of a 200-foot steel ribbon, externally located on the right side of the *Cub*. When a firing button is pressed, the anchor is shot into the ground while the plane is still airborne. Deceleration is effected by the ribbon passing through small friction brake shoes.

The present installation weighs 18 pounds for the 1,200-pound *Cub*, but All American Airways says the gear is adaptable to heavier and faster aircraft.



under the direction of a very smart underground agent who also supplied the crews liberally with Czech kroner.

In Zatec we lived at the *Zlety Lev* (Golden Lion) and Stalingrad hotels. Everyone we talked to in the country was very pro-American and pro-Israel, and everyone I talked to was definitely anti-Communist but hoped that their country would be neutral in case of an East- West war. Most of us, despite strict orders from Tel Aviv, also did a bit of black market trading, since dollars brought 480 to 520 in the black market instead of the official 50 to 1. Back in Tel Aviv the people were hungry for electric irons, radios, jewelry, and whatever else we brought in, no questions asked. At Zatec we posed as members of a commercial air line. In Prague, where we usually went for fun and food, we were "students."

We had to close down Zatec in a hurry last fall when an Israeli deserter spilled the works to the United States, which complained to the United Nations, then busily engaged in trying to stop the war. The crews got all the planes away except a four-engined job which had been damaged, but we lost all of our warm clothing. After that, continental operations shifted to another Iron Curtain country, Jugoslavia, which gave Israel the use of a small base at Nicsic, in Montenegro. Down there we had no radio guide and we navigators had to be careful to avoid the Jugoslav fighter bases. Sometimes the "Jugs" buzzed us in their Russian *Yak* fighters, but gave us no trouble. We did no fraternizing at the air base (if you saw those hefty Montenegrin babes, you'd know why), and flew in all of our own food, since the country is very poor. Apparently the guerrilla war between Tito's Partisans and the hunted Chetniks was still going on. At night we always heard rifle fire in the nearby mountains. About a month after Zatec was closed down, the Czechs succeeding in sending to Nicsic by rail most of the rifles, pistols, machine guns, hand grenades, ammunition, and aerial bombs Israel was buying there, and when I left the "Jugs" were making a deal, at a better price, to sell some of their own arms.

Our hardest work came when the fighting in the Negev desert flared up, and the Egyptians cut the main supply road to isolated garrisons and communities. We dropped everything else and pitched in running an improvised air lift, all night long, every plane making at least three or four flights. It was only a short air haul of about 25 miles from Tel Aviv, but it took about 40 minutes since we had to reach 5,000 to 7,000 feet before running the anti-aircraft gauntlet.

The Egyptians had quite a lot of 40 mm. ack-ack and many fine German 88's which the British had captured in the western desert and given to Egypt. But they were miserable gunners. If they hadn't been we would have had serious trouble. As it was, most of our planes were hit at some time or other by light stuff. At the desert termini of the air lift, what we called Dust Bowl No. 1 and 2, unloading was often done by front line troops who'd break open the boxes, load up with grenades and "ammo" and race the mile or so back to the firing lines. We had to be alert for Arab snipers who would infiltrate the lines every night to shoot at the crews and planes. One night I saw two Arabs killed while they were laying mines at the end of our runway.

We tried to be off and away by dawn, but sometimes I'd stay over a day to go out with the Palmach hunting Egyptians on Jeep raids, much as one might organize a rabbit hunting expedition. I never bagged any. Nor did I make any scores in Jerusalem where I went twice to visit the front, then held by the Irgun Zvai Leumi, a former terrorist outfit, absorbed, temporarily at least, into the Hagganah. My favorite sniping spot in Jerusalem was the Church of Notre Dame, then a legitimate Arab target.

It was down in the dusty Negev, however, that we found the body of a pilot from Chicago, a gentile mercenary, who had been forced down. The Arabs had hacked his body to pieces and strewn it over the desert. It was in the Negev, too, that I saw my most horrible sight, in the village of Negva, just after its recapture by the Palmach.

A Palmachnick, his eyes burning in fiery anger, led me down a basement stairs. In one corner were piled the headless bodies of 35 Jews, including two women, all members of the farm. Their heads were stacked in another corner. As I stumbled outside away from the grisly sight, I met another Palmach, a captain, who was cleaning reddish stains from a curious curved knife. He too had seen the evidence of wanton massacre.

His reaction had been swift and instinctive, in keeping with the ruthless eye-for-an-eye warfare of Palestine. The captain herded the first 18 prisoners taken by his men into another basement, took a knife from one prisoner, and then slit every Egyptian throat. There had been two women in the lot. He gave me the knife for a "souvenir."

And that's the way it sometimes was in Palestine, before Dr. Ralph Bunche succeeded in arranging an armistice between Israel and Egypt, on a pattern which gives promise of being followed by the other Arab states which were at war with the new state of Israel. But the peace talks flowered after I left. Like many of the other ATC personnel, I decided to come home when it appeared that some of the big wheels in Tel Aviv were starting to organize a rival air line which would be in a better position to operate commercially after hostilities were over. By this time, too, our job was just about done. Israel was a state, a victorious state. It was time for an "old" sailor to look for a new berth. END

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(Signed)

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Crop Dusting

(*Continued from page 40*)

is by far the fastest and best means of combatting them.

The CAA warns that aerial dusting and spraying is, however, not a one-man job. The lone pilot cannot do it by himself. He needs to know the operation of the plane and its maintenance, that is true. But he needs in addition, the proper scattering apparatus; and the services of chemists, entomologists, and plant pathologists to determine the causes and cures of the difficulty. Botanists and plant pathologists will know the formulas which will be most effective in individual cases. The farmer who hires the crop-dusting outfit must be completely informed of the advantages and limitations of the planes and methods. All this is necessary if agricultural flying is to continue its strong growth.

Some of the problems of spraying and dusting operations are listed below by subject heading. They are not meant to be the final word on the subject but merely to suggest that operators need to have more than a properly equipped plane and the ability to fly.

CAA Regulations

Spray or dusting installations must be approved by the nearest CAA office. Drawing or a detailed sketch must be submitted. CAA-approved dusting, spraying and seeding installations kits are available commercially.

When an installation has been completed, Form 337 must be filled out in triplicate, and the installation must be inspected by a CAA inspector, checked with a licensed mechanic, and must comply with safety regulations. A certificate of waiver is necessary.

CAA publications of value to sprayers converting aircraft are:

Manual 3: "Airplane Airworthiness: Normal, Utility, and Restricted Purpose Categories."

Manual 4: "Airplane Airworthiness."

Manual 18: "Maintenance, Repair, and Alteration of Certificated Aircraft, Aircraft Engines, Propellers, and Instruments."

Recent publications by the United States Department of Agriculture describe installations made in a number of planes. These are "Aircraft for Spraying and Dusting," EC-2, March, 1948, and "Equipment for Dispersing Insecticides from Aircraft," October, 1948.

Some manufacturers of CAA-approved dusting and spraying installations are:

Barrie Aeronautical Corporation, Lee Airport, Lockport, N. Y.

Bell Aircraft Corporation, Niagara Falls, N. Y.

Central Aircraft, Yakima, Wash.

Goettl's Metalcraft Company, 2431 East Bucana, Phoenix, Ariz.

Ong Aircraft Corp., P.O. Box 214, Kansas City, Mo.

Planes and Hazards

The original Huff-Deland *Duster*, the one plane originally designed for dusting, is no longer built. Recently, Piper and Luscombe announced special crop dusting and spraying planes. Several other lightplane companies have hopper designs. Nearly all the planes now in use have been converted by individuals and by one or two firms. Most often they are *Wacos*, *Travel-aires*, Stearmans, Fairchilds or Standards.

The dusting plane must be maneuverable, safe at low speed, carry a good load, and have ample power to climb steeply at the end of its swath. The pilot must not only be skilled in general flying but must have made a close study of dusting techniques. Certain dusting materials are flammable and others are poisonous to the pilots. Apparatus must be designed to prevent sparks from igniting the materials, and to keep the chemicals away from the pilots when they are being scattered.

The U.S. Department of Agriculture has development work under way on hoppers, agitators and pumps, and publications describing apparatus and containing plans and specifications, referred to in the preceding paragraph, can be obtained from the Bureau of Plant Industry, Soils and Agricultural Engineering.

Crop dusters must be especially careful about their liability for damage to neighboring crops. Some local areas have ordinances against the use of 2,4-D. Other ordinances affect other phases of the business. They should be checked carefully before the pilot signs spraying and dusting contracts.

To Dust or Spray?

Airplane dusting began in 1921 and after a brief flurry settled down to a position of "mediocre competition" with other control practices. The discovery of new and powerful insecticides that can be formulated easily into concentrate sprays has opened the way for aerial spraying and is responsible for the recent great upsurge in aerial control.

Virtually all aerial dusting equipment tends to give very uneven distribution of the insecticide, according to G. C. Decker. There are excessive amounts in the center of the swath, tapering to zero at the margins. The main advantage of dusting, Decker says, is its speed. He doubts that it can compete with spraying in most applications.

Spray applications give greater flexibility, a more uniform spray distribution when spray booms are used, and greater control over drift.

Legal Pitfalls

Among the provisions a written contract between an independent spraying contractor and a farmer might cover, according to H. W. Hannah, are (a) time or times; (b) area; (c) spraying or dusting; (d) number of coverages; (e) air or ground; (f) cost, or basis for determining and rate charges; (g) when payment is due; (h) will farmer furnish anything? water supply? spray materials? assistance? who mixes spray or dust? (i) spray or dust to be used, strength of mixture and concentration of the application; (j) bad weather escape clause, (k) liability, and (l) other?

Operators should consider liability to themselves and their employees from negligent acts of the farmer or his employees, condition of the premises, and failure to warn. Liability to the farmer may arise from negligent acts of the operator, damage to the farmer's property, to his livestock, or to his person, members of his family and employees. Operators may also be liable to third parties.

Insurance for crop dusters is a constantly changing situation. It takes years to build up adequate insurance experi-

"It's interference from the airport's GCA system."

ence that can be translated into rates, and crop dusting and spraying is simply too new a business. Newell Weed of Marsh, McLennan Company, Minneapolis, advises operators to plan their insurance well in advance. He suggests they work through brokers who will shop around for better bargains. Weed recommends that operators work in a provision in their contract that they would be "held harmless" under certain special circumstances. He also recommends that all liabilities be listed specifically in the contract.

If all this seems discouraging, nevertheless wise operators will study the problem thoroughly.

New Insecticides and Weed Killers

A number of new insecticides, many of them experimental, are being developed. These include the chlorinated hydrocarbons, such as DDT, benzene hexachloride, chlordane, and chlorinated camphene. Organic phosphates include hexaethyl tetraphosphate (HETP), Tetraethyl pyrophospate (TEP) and parathion. Miticides include dinitro compounds, oils, sulfur and organic phosphates.

Weed killers include 2,4-5T (Trichlorophenoxyacetic acid) a chemical similar to 2,4-D which has proved even more effective against woody plants than 2,4-D, though not against ordinary weeds. TCA (Trichloroacetate) is a relatively new chemical effective against grasses. Applications of 100 pounds per acre have eliminated quack grass. More experimentation is needed, however. Experiments are also underway on Pentachlorophenol (PCP) and MCP as weed killers.

Toxicity of Spray Residues

Chemicals which are toxic to insects are also toxic to animals and birds, although their degree of toxicity may be lower. Lead and arsenic are especially dangerous to animal life though they have been extensively used in sprays. Special precautions should be taken to prevent poisoning of ponds where animals drink, and of pastures and grains. Mercury and nicotine are also highly dangerous. The newer insecticides are not as dangerous as the older ones but the oily preparations seem more toxic than water solutions or dusts, except to aquatic life.

It is known that DDT is toxic to fish at between 0.05 p.p.m. and 0.10 p.p.m. Chlorinated camphene is considered more toxic than DDT while benzene hexachloride and chlordane is less toxic than DDT. Tetraethyl pyrophosphate is comparable to DDT, parathon is slightly less toxic, rotenone is toxic, 2,4-D is non-toxic, sodium arsenite is not toxic at 1 to 4 p.p.m. Trichlorobenzene is toxic to fish at levels which will kill aquatic plants.

On animals, DDT at a concentration as low as 4.36 pounds per acre had a lethal effect on songbirds, especially among ground and low-strata feeders. At .6 pounds per acre, applications apparently had no effect. Applications of 5 to 7.5 pounds per acre seriously affected small mammals, but these were not affected by treatments of one pound per acre. Bobwhite quail suffered little or no loss from spraying of five pounds of DDT per acre, five pounds of DDD per acre, 5 pounds of benzene hexachloride per acre, or five pounds of toxaphene per acre. END

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I Learned About . . .

(*Continued from page* 46)

fates had decided to close all the bad weather in from all sides. I was flying in the only clear area and it was so small that I ran into bits of scud which snatched at me like groping hands. Each time this happened I became momentarily blinded and my heart did another flip-over.

I flew up and down Route 3, a four-lane highway with a narrow island in the middle, thinking that if worst came to worst I might be able to land on the roadway. It was a bad bet though, with criss-crossing telephone lines and a dead cross wind. Each moment became more valuable because I knew there were only a few left at best.

I was down to 400, then 300, and finally 200 feet, cruising up the highway looking for a field. On these excursions up and down the highway, blocked by the blanket closing in from each end, I passed three small fields about 150 feet long and separated by three small stone walls. The walls looked about four feet high and a foot thick. I had discounted these fields at first for obvious reasons—walls, short distance, and wires at one end—but mostly because of the walls—they meant suicide. Finally I had to face it. Those fields were the only possibility (bad as it was) left. One more trip up the highway and into that rain and fog and that would be all. I had no instruments. I couldn't fly out of it since it was closing in from all directions; and it would be sheer stupidity to try to fly over it. So I finally concentrated on devising a way to get in there. I could imagine myself hitting a stone wall in a *Cub* going around 50 m.p.h., with an engine sitting in my lap.

But I figured that with some luck, some skill, and enough nerve to keep me from going panicky, I should be able to land on my wheels in the first field and still keep enough speed to hop the first wall and stall to a landing in the second field. If I miscalculated I would either lose my undercarriage on the first or second wall, or flip on either one. No matter how I sliced it, it spelled trouble. Or maybe I might lose my undercarriage and come in on my belly.

The ceiling was about 200 feet when I made the final approach. I couldn't drag the area because by the time I got around again I would have lost the field in the fog. That final approach will live with me for many a year. I was scared silly.

I wheeled in the first field going like hell, wheels touching. I chopped throttle and the wall came at me fast. I hauled back on the stick and prayed. I gave her a little throttle so she could clear and over we went. The second wall came from out of nowhere. It seemed that in spite of throttle and sufficient flying speed, it would take sheer will power to pull us over *that* wall. Over we went. The little *Cub* hit hard on the wheels and bounded three or four times, almost ground looping. Then she rolled to a stop about 10 feet from the third and last wall.

I cut the switch and half crawled, half fell out of the *Cub*. I had made it. And I also had the shakes. Some people who had gathered to see the fool kill himself gave me a much needed drink.

But all was not over yet.

After completing that landing without so much as a scratch on the plane or myself, I decided to fly her out the next day.

Next morning dawned clear with a brisk southwest wind. Really CAVU. At the field I found the local fire department, State troopers, reporters from two newspapers and a representative of the local radio station—plus a crowd of local citizenry who wanted to see a man kill himself with an airplane. I was determined to take every precaution in taking off. There were the usual willing onlookers who helped push the plane down to the corner. As the wind was southwest, I had to take off diagonally with the walls. Parallel would have meant a stiff cross wind and in a field that was rough and the terrain uncertain, I wouldn't chance it. I was already taking more chances than I should have.

We marked all the large rocks in the fields with handkerchiefs borrowed from the spectators, putting the handkerchiefs on sticks and sticking them in the ground next to each large rock. The field would have been perfect for a quarterback who needed to develop his broken field running. Even so, I picked out the most likely course and decided on my "taxi plan": 150 feet of broken field and then a wall; hop the wall and taxi on wheels to gain sufficient flying speed to clear the second wall—giving me 300 feet in a 35-m.p.h. wind.

As a precaution I strapped the rear seat cushion and back cushion to my chest and between my legs. This would at least lessen the danger of serious injuries in the event I hit the wall.

At the end of the three fields, telephone wires were strung up across the road. These worried me. If I cleared the two walls, I still had to contend with the wires. But I concluded that *if* I cleared all walls, I should have sufficient speed to make a light bank to the right and just miss the wires. After strapping on my cushions, I revved up the engine, having previously heated it and thoroughly checked the entire plane. I then ran the r.p.m. up to 2,300 and let go the brakes. The *Cub* shot forward—and promptly slowed down. By the time we reached the wall I knew we would never make it. I braked to a stop about 15 feet from the wall, and taxied back to the starting point for another try. The second was similar to the first except that I found a better broken field path—but again I felt I couldn't make it after running up to the wall.

Win, lose, or draw, I was determined to make the third try my last one. It almost was. I revved her up to about 2,300 r.p.m. and let her go. My tail was up almost in the first five feet. We again shot forward—but the forward motion seemed mighty slow. Each rock and bump slowed the plane so that I thought we would never make it. The first wall came up fast. I remember thinking to myself that if I missed this one it would make an awful mess.

We passed the first of the white handkerchiefs and then the second, and when I thought that I could clear I pulled back as gently as I dared and we hopped over the first wall, but—and then my heart stood still—we mushed and settled into the ground. I didn't have enough flying speed to keep the plane in the air. However, I did have more speed than when I started and it was sufficient to wheel along to the next wall which I cleared. I thought as soon as I got over that I would have pretty clear sailing. But (another of those but's that flying is full of), I still had to reckon with the telephone wires.

After clearing the walls, I gained about 25 feet of altitude and had to make a low altitude down wind turn to avoid frying on the wires. With my heart riding permanently in my mouth, I cleared the wires. From there on, with careful flying, I turned back into the wind and slowly gained altitude until I had 1,000 feet.

The relief was so great that for the moment I didn't know which way to turn

BABY TURBINE

STARTING turbo-jet engines has long been one of the most difficult problems of jet operation. Under good conditions, the best aircraft batteries are good for only a half dozen starts before they need re-charging.

A tiny powerful motor like this may be the answer to the jet starting problem. It is a rocket fuel turbine, designed and built by E. A. Maynor, Chicago, who is shown

holding it. The little motor weighs only 14 pounds and delivers a maximum of 125 h.p. It has been successful on 87 tests. It burns nitric acid and furfurol which are spontaneously combustible when mixed. The expansion of the burning gases operates the turbine exactly like a conventional turbo-jet engine. The baby turbine is 7½ inches in diameter and weighs 30 pounds with enough fuel for 10 starts of 30 seconds each, according to Maynor.

and I had to check up on my bearings with the state highway below. After one last look at my small personal landing field with its three stone walls and the diminutive rock-filled grass plots that were once my runways, I headed back to Groton and vowed:

1) Never again would I fly without a chart.

2) Never again would I take so much time to select an emergency field.

3) Never again would I take off without accurate information as to the possible weather conditions.

4) Never again would I take off from a doubtful area—but dismantle the plane and truck it out.

And finally I resolved as a flight instructor to impart special emphasis on the need for real instruction on emergency landings of all types.

Yes, I was lucky—probably luckier to get out than I was to get in. I really learned about flying from that! END

Navy's Air College

(Continued from page 24)

wants. All you've got to do is get in touch with ONOP. No use trying to say it fast—The Office of Naval Officer Procurement. You can do it by letter to: ONOP, Bureau of Naval Personnel, Navy Department, Washington 25, D. C. Just say you're interested in being an Aviation Cadet. Or, if you're in town, drop into the Navy Recruiting Station. Or, if you live in a major city, look in the phone book and see if there's a branch of ONOP. People at any Naval Air Station, ship, or base will be glad to tell you what to do.

After you get all the dope, think it over awhile. Because when you take the next step it might be the biggest one you ever took. You might walk right into your life's career—as Naval aviator and commissioned officer, USN.

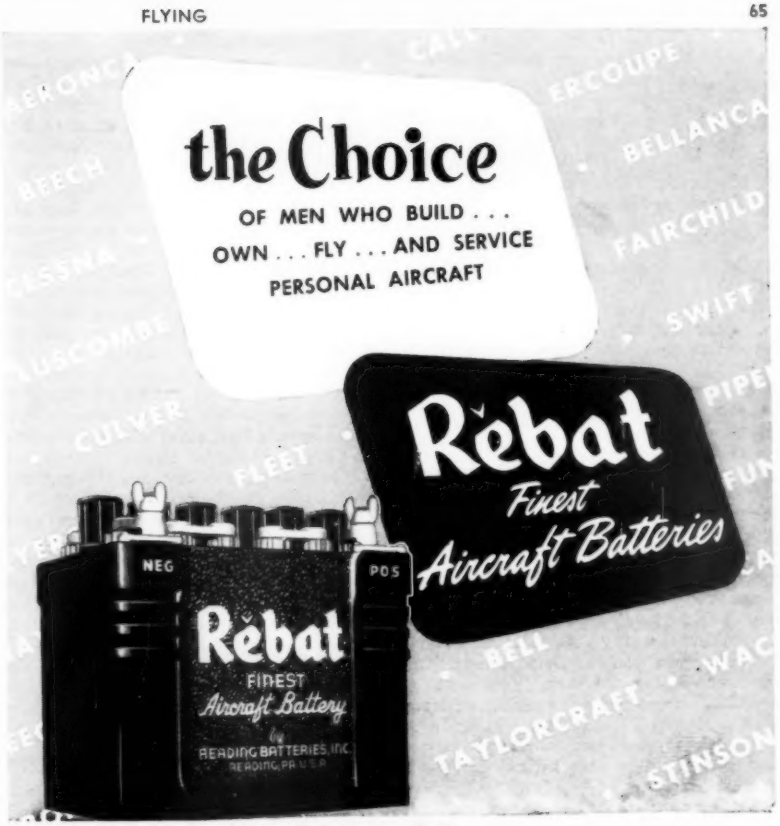
Let's look at the proposition. The Navy wants four years of your time. During them you will be trained as a pilot, commissioned, and serve with the Fleet.

For those four years here's what you will get aside from the finest flight training in the world:

As an aviation cadet you will get, free, your lodging, food, medical and dental care, transportation, necessary equipment (such as airplanes and computers), and $10,000 worth of life insurance. You will, in addition, be paid $75 a month (Congress may up this to $115), and $180 with which to buy uniforms. And your service will count toward either regular or reserve retirement, as well as for longevity pay.

When you are commissioned, your pay will increase to $291 a month and you get an additional $150 for uniforms. Medical and dental care and transportation are still free, your lodging aboard ship is also free and your mess bill at sea is very small. And you will get a 5 per cent increase in base pay after three years.

After 18 months of duty in the fleet you may apply for a commission in the regular Navy or Marine Corps, but if you



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You're in! You're a Naval aviation cadet. All around you in the dormitories of the Flight Battalion at Pensacola's Main Station there are men like you, a couple of thousand of them. All in the same uniform. All with the same problems. . . .

Because reveille is at six o'clock in the morning and you've only got 15 minutes to make the mess hall. (But console yourself, Joe. Your money allowance for food is 50 cents a day more than that allowed an admiral so you're an Important Man.)

An hour and a half after reveille and you're in class. Navigation. The NAVCAD beside you whispers, "Boy, if I'd known I was going to get a *thousand* hours of this stuff, I'd have stayed home."

Don't let it worry you, Joe. As a Navy navigator you won't be flying wing on the man who knows the way. You can't afford to because you'll be taking off from a ship making 30 knots for a three-hour flight over an empty ocean and you're going to want to be able to find that deck again, bad.

And, as your shoe soles wear out, you're going to hear a common remark around Pensacola: "When do we fly? I joined up to be a junior birdman and all I do is walk my legs down to little stumps."

Joe, you've got four months of waiting before you ever get into an airplane. Not thumb-twiddling waiting, though. You're going to be so busy getting yourself into top physical condition and alert mental condition that you'll be surprised how fast the time goes.

Navy flying is the world's toughest and to do it right you've got to be more than a good stick-and-pedal boy. You've got to *know* a lot.

So the next 16 weeks of your life are spent on the ground while the Navy does two things to you. One is to get you into better physical shape than you've been in since you were six years old. While you're getting in shape, you're also going to ground school. You've got about 625 hours of scheduled classroom or practical work. You'll learn about weather, air regulations, communications, engineering, gunnery, principles of flight and, of course, navigation. You will also begin to learn how to be a naval officer, learn how to be led and to lead others.

Those 16 weeks are rugged and you won't have much time off between six in the morning and 10 at night, but they don't last forever. The day finally comes when you pack up and leave the main station, leave the more-or-less military school atmosphere of the flight battalion. You're on your way now to what Pensacola calls an "outlying field."

It's no cow pasture, Joe. Some of the "outlying fields" make the Main Station look like a two-bit airport. Out there you'll find a different kind of life; freer, better, more exciting, and tougher.

Joe, meet the *Texan*.

Officially you've progressed to Basic Flight Training and here's your airplane, the Navy SNJ—the *Texan*. She's a single-engined, two place, low wing monoplane whose 550 horses fly her at 200 m.p.h. The old Navy biplane trainers are gone and the *Texan* is a real airplane with everything in the cockpit up to and including instruments for blind flying and two-way radio.

On the flight line now you meet a lot of other people and realize that Navy flight training is a bigger project than just teaching you and your 2,000 cadet buddies. For now you meet USN officers, a lot of them with battle-won medals. There are Marines, Coast Guardsmen, and Aviation Midshipmen. And there are a lot of South and Central Americans—nice guys from Argentina, Brazil, Mexico, Cuba, Peru, Colombia, Ecuador. There are even men here training to fly the Berlin airlift.

Your first 25 hours in your *Texan* will be dual with an instructor trained during the war. You'll go through basic maneuvers, landings, take-offs, turns, climbs and glides to get you ready for the trip with that big, empty seat up front.

That'll cost you a buck, Joe, because you've soloed and you get the ends of your necktie chopped off.

And now hold your hat. The country around Pensacola is real pretty with the blue-green Gulf, the white beaches and green land. But you never saw a country that could whirl around, appear and disappear, come up at you and fade the way it can around there, as you learn acrobatics in your *Texan*. Or the way it feels under the hood while you learn blind flying. Or how close and bright the stars are at night when you're up around 5,000.

Just when you think you're good, though, they throw Tactical at you. You're going to sweat. Formation flying looks so easy, those planes look like they're just hanging by wires up there. Wait until you've tried it. Wait until you find out how hard it is to make a smooth cross-over. You see, you've come along far enough now for the Navy to think that you can handle problems the way they'll really be when you start flying in the fleet. They make it hard on purpose so it won't be so hard when the chips are down.

You've been in the air for 175 hours now and you *are* good. You'll fight the man who says you aren't.

Come along, Joe. Meet the Landing Signal Officer. Look down there. See that rectangular outline painted on the runway? That's like a carrier deck. Come on around to the upwind leg and then turn your airplane over to the LSO. Let that little man down on the ground waving those flags have it. You just sit and do what he says. Get that left wing up and don't stall the thing. Come on! Okay. There goes the cut.

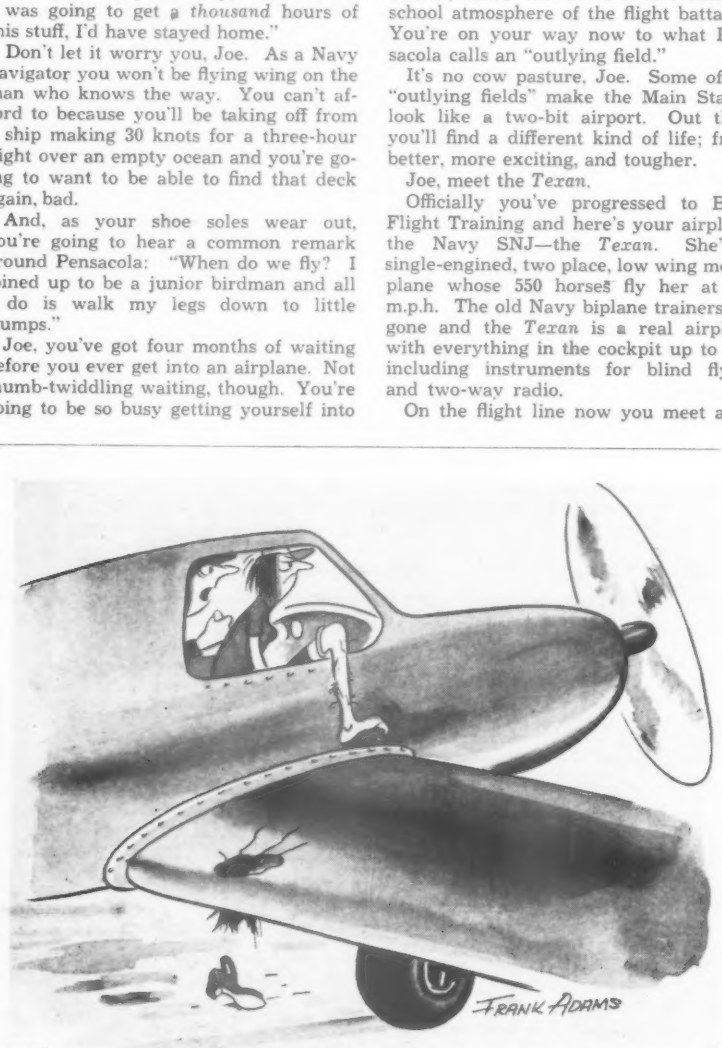
Holy mackerel, what a jolt! That airplane of yours dropped in from 20 feet and all this time you've been told to smooth it on. Oh, well, that's the Navy.

You've been an aviation cadet for about 10 months now and at last you've convinced even the Navy that you're good. So the next step is just routine—to the Navy.

You and your classmates make another move. This time up a ladder and into the cave of a carrier's hangar deck. You don't have a qualm as you look around aboard the *U.S.S. Cabot*, a light carrier. Why, the thing is big!

Sure it is, when you're aboard it.

The next morning, altitude 2,000 feet, you look down and find that somebody has swapped the *Cabot* for one of those plastic bathtub carriers. How do they



FLYING

"What was all that fuss about while you were getting in?"

expect you to land an airplane on *that*?

You can do it, Joe. You're so close now to being a naval aviator that these next six landings you've got to make on a carrier won't be too hard. Come on around and try it. And remember the ice cream for the Landing Signal Officer when you've put her down in the gear six times.

You've finished Basic, you've qualified on the carrier, you're ready for Advanced training.

This is a fork in the road for you, Joe. Some of the good friends you've made are going one way, you the other, for Advanced training is divided into carrier-based or patrol type aircraft. Whichever type you get, all of you go next to Corpus Christi, Tex., where all Advanced training is done.

The time really flies now because there are only about 14 more weeks before you get that commission as ensign (or second lieutenant if Marine aviation is your dish). If you're assigned to patrol planes you'll be flying either SNB's (*Bombardiers*), PBM's (*Mariners*), or P2V's (*Neptunes*). If you're a carrier pilot you'll specialize in the planes which take the attack to the enemy—*Hellcats, Corsairs, Avengers.*

Then it's all over. You're now Ensign Joe Jackson, Naval Aviator. Nice going!

Let's look back at what you've done before we look ahead at what you'll be doing in the future.

For 18 months you've been an aviation cadet. You spent 16 weeks in Pre-Flight; 12 weeks in primary and acrobatic flying; five weeks on instruments; eight weeks in tactical; three weeks to qualify on the carrier—28 weeks in Basic. Then 14 or 16 weeks in Advanced. In all, you've had 1,384 hours of instruction, not counting about 400 more hours of briefing and post-flight discussion. You've spent close to 300 hours in an airplane.

What's ahead for you, Joe?

The Fleet.

As a completely trained aviator you'll go right into an operating squadron. You're part of the Navy now, Joe—the Navy Admiral Halsey was talking about when he said, "We'll go anywhere in the world we damn please."

So, Joe, congratulations! END

Air Force School

(*Continued from page 27*)

groups formerly consisting of 1,200 to 1,500 now number around 600, allowing more effective use of equipment and instructors.

Cadets begin training at one of four Texas bases: Randolph, near San Antonio; Goodfellow at San Angelo; Perrin at Sherman; and Waco. They move to advanced bases at Williams, Ariz., or Las Vegas, Nev., for single-engine training; Barksdale at Shreveport, La., or Enid, Okla., for advanced twin-engine training. Of cadets completing basic training, two-thirds go to twin-engine training and one-third to single-engine planes for advanced training.

At Barksdale and Enid, cadets fly 70 more hours on the T-6, of a total of 200 hours, then fly the B-25 for 65 hours. At Williams, they take 100 hours on the T-6, or a total of 230 hours, and then fly the F-80 for 35 hours. The same schedule applies to Las Vegas, except that after the 100 hours on the T-6 cadets at that base finish on F-51s.

Cadets assigned to jets get their first taste of an F-80 in a plane that never leaves the ground. Called *Captiv-Air*, it is a *Shooting Star* anchored to a concrete stand, but with all the power and equipment for flight. The future jet pilot begins by climbing into the cockpit, assuming that for all practical purposes he is at the controls of an F-80 about to take off. Nearby in a small building other cadets stand by with earphones to listen to an instructor give orders to the pilot who simulates landings and take-offs. His actions are reflected in a set of instruments mounted on a table inside the building and watched by the instructor and students. After that transition a cadet goes to actual flights in a TF-80C, the two-place trainer made by stretching an F-80 three feet to accommodate cadet and instructor. Once the cadet qualifies to solo, the F-80 is his for the rest of the course.

The 130 hours of basic flight training is divided into eight phases: pre-solo, contact proficiency, accuracy stage, night local, navigation, formation, acrobatics, and instrument time. Cadets also spend 20 hours in an instrument trainer. The advanced part of the flight training, covers these items at an advanced level. Cadets also receive instruction and training in aircraft engineering, weather, navigation, principles of flight, applied aero physics, flying safety, radio communication, flight instruments, and aural and visual code.

For ground officers, the Air Force maintains a candidate school at Lackland Air Force Base. Men commissioned from this school become specialists in meteorology, communications, air traffic control, airport and air base management, shop management, maintenance, and other specialties required in the peace-time Air Force.

The Air Force is particularly interested in obtaining a pool of college-trained men which it can send to Air Force technical and administrative schools for advanced work in electronics, meteorology, atomic energy, aircraft design, rocket propulsion and other scientific and technological developments.

To be eligible for flight training, candidates must (1) be between 20 and 26½ years old, (2) have at least two years of college, or be able to pass an equivalent examination, (3) be in good physical condition, with high requirements for eyes, ears, heart, and teeth, (4) and be of high moral and personal qualifications. Applicants can get blanks at local Army and Air Force recruiting stations or at any Air Force Base. Final exams are given at approximately 60 Air Force bases by an Examining Board. END

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have proved their merit

The improved Flottorp propeller that's "Smooth as glass but armor coated" has proved its resistance to abrasion and moisture. Many of these props have flown hundreds of hours and they *look* and *are* as good as when installed. In every case the new Flottorp propellers have proved their merits.

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AIRCRAFT PROPELLERS

Used Planes

(*Continued from page 37*)

radio $1,550, without radio $1,440; 1947 model, $2,000; 1948 model, $2,700.

Fairchild: F24 (post-war only), $3,000 to $4,000.

Funk: B, $1,775 to $2,350.

Globe: *Swift* 125, $1,800 to $2,500.

Grumman: *Widgeon* 44, $7,500 to $10,000; *Widgeon* 44A, $12,000 to $16,000; *Mallard*, $90,000 to $130,000 (when available).

Luscombe: 8A (1947), $1,100 to $1,500; Deluxe 8E (1946), $2,200 to $2,800; *Sedan* (1948), $6,500. Later models, higher.

North American: *Navion*, $5,000 to $6 500.

Piper: PA-11 (1948), $1,500 up; *Supercruiser*, $1,800 up; *Family Cruiser*, $3,185 to $3,600.

Republic: *Seabee*, $2,200 to $2,775.

Ryan: *Navion*, $7,500 to $9,500.

Stinson: 150 *Voyager* (1946), $2,500 to $3,000; 165 *Voyager*, $3,700 to $4,300; *Station Wagon*, about $200 more than 165 *Voyagers*.

Taylorcraft: BC12D (1946), $1,000 to $1 300.

Temco: *Swift* 125, $2,500 to $3,000.

Among the smaller airline types, Lockheed *Lodestars* range from $35,000 to $45,000, while Douglas DC-3s with 24-volt electrical systems range from $20,000 to $25,000 for cargo versions, from $25,000 to $40,000 for passenger types, and from $80,000 to $100,000 for deluxe executive conversions.

Some of these prices may shock prospective buyers or sellers. It is important to remember, however, that these are not arbitrary listings—they are actual compilations of current bid and asked prices in the present used plane field. Occasionally, individual planes may be priced higher or lower than the range indicated, depending on special equipment, condition and the reasons for sale. As brokers we do not decide the prices ourselves. Our job is to find a common meeting ground for those who have to offer and those who wish to buy.

In this connection, while we have used an analogy with the automobile business to demonstrate the probable future relationship of a used plane to a new one, actually we feel that aviation sales more closely approximate the yacht and power boat business. In prices, types of markets, comparative utility at present and, probably most important, in sales problems, the lessons of the yacht business can be applied on a more concrete basis to private aviation than is possible with automotive sales.

For this reason, and because of past experience in both fields, we follow the time-proved rules and regulations of the Yacht Brokers Association of New York in the organization of our records, the setting of commissions and the avoidance of misleading advertising. Following standard brokerage procedure, commissions are 10 per cent of the first $2,500 (minimum commission of $100), seven per cent of the balance up to $20,000, and five per cent of all amounts over $20,000.

Besides handling hundreds of planes on a nation-wide basis we make surveys of registered aircraft owners in 12 eastern states and the District of Columbia twice each year, with an extra mailing to be added this summer. Of about 15,000 "availability for sale" cards we send out each time, we find that we receive a listing of about 1,000 planes for sale, or about 7 per cent of all planes available in these states. Considering the present economic pattern this would not appear to be too large a ratio.

It has not been possible, thus far, to predict with any accuracy used plane activity in particular regions of the country. For no recognizable reason there were some excellent used plane values available in the south central states this winter, but the summer peak may find the best market offerings in the northeastern or western states. At the present time there are more good used airplanes available throughout the country than at any time since World War II ended, and cash-backed inquiries for planes are on the increase. END

Station in Space

(*Continued from page 21*)

the earth, and losses caused by the turning motion of the vehicle. In some cases the corrections must include the rotational velocity of the earth. The ideal velocity is shown in Figure 4 (see next page); the corrections may be assumed to amount to a $3\frac{1}{2}$ per cent increase in required velocity.

The required mass ratio for the vehicle may be calculated by the well known relation, $v = c \log M_i / M_f$, where c is the velocity of the jet and M_i and M_f are the masses of the vehicle before and after burning. The required ideal velocity, v, may be determined from the curve of Figure 4.

If a jet velocity the same as that of the German V-2 missile (6800 ft./sec.) is assumed, the mass ratio required is 60 for a vehicle orbiting at an altitude of 300 miles. This is certainly unattainable in a single stage and is probably not attainable in two stages. It is possible with three stages, but either the take-off size must be very large or the pay load must be very small.

Alternatively, if it is assumed that the mass ratio is fixed by design requirements to the same value as for the V-2, (3.3), the jet velocity required for a single stage is 23,000 ft./sec. This is far above the possibilities of the best theoretical chemical fuel, hydrogen. It is theoretically possible with atomic energy, but a practical method of using this source is as yet unknown.

It is apparent from the above that both a higher mass ratio and a higher jet velocity than the V-2 are required for the satellite. Actually, improvements in materials and structures, to permit attainment of higher mass ratios, and in fuels and motors to give higher jet velocities, are underway for several developments.

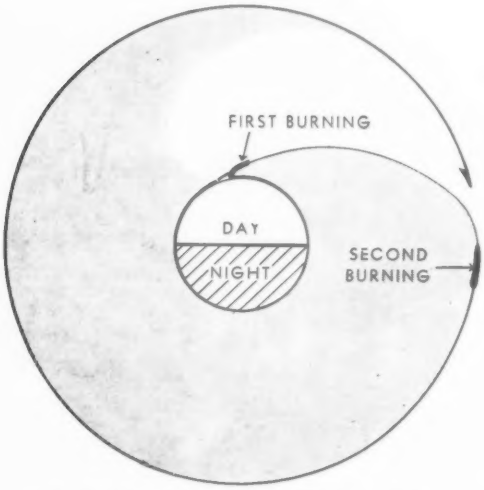

Figure 2. Desired orbit of a satellite vehicle.

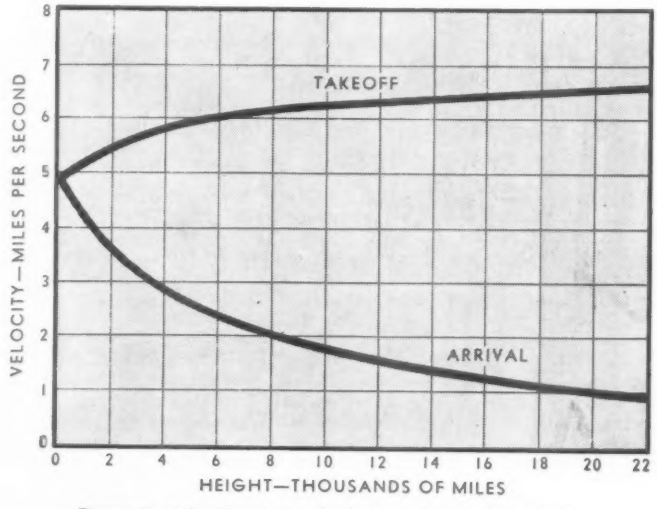

Figure 3. Take-off and arrival velocities of a satellite vehicle.

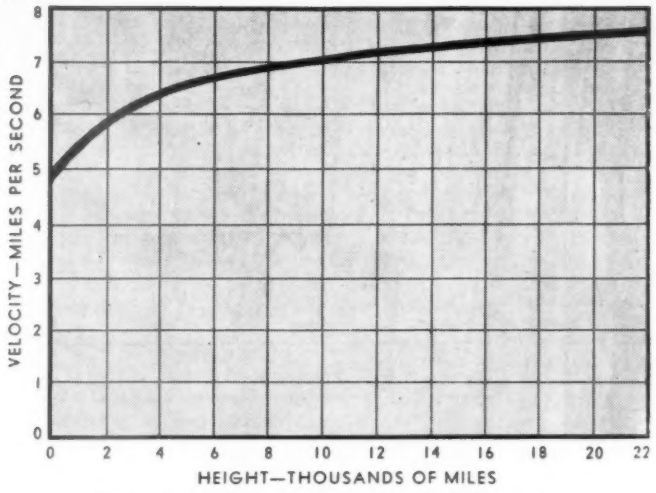

Figure 4. Required ideal velocity for a satellite vehicle.

These will be helpful in the satellite program to the extent that it would be possible to commence immediate design of a two-stage vehicle, and probably also of a single-stage vehicle, with each of these having a reasonable size and a reasonable payload.

The preceding discussion, though brief, serves to demonstrate that the satellite is technically feasible at the present time. The remaining question then is, is the satellite desirable? This can best be answered by considering several of the possible uses of the vehicle.

In general, the applications of the vehicle arise from its unique height above the earth. This makes it desirable to consider first the relations which exist between the vehicle and the earth, with due regard to altitude, orbital path, and the earth's rotation.

Figure 5 is a sketch showing the geometry of the more interesting relations. These are the height, the maximum line of sight range, the visible arc of earth, and the half vision angle. An additional relation is the true period of the vehicle, which may be computed from Figure 1. These various relations are tabulated in Table I (below) for vehicle heights from 53.5 to 22,300 miles.

Relationships Between a Satellite Vehicle and the Earth

Height (Miles)	Range D (Miles)	Vision Arcs (Miles)	Vision Half Angle Ø	Period T (Hours)
53.5	705	700	80°	1.41
257	1455	1400	70°	1.59
620	2310	2100	60°	1.76
1210	3350	2800	50°	2.06
2222	4750	3500	40°	2.64
4000	6920	4200	30°	3.95
7650	11000	4900	20°	6.95
19000	22700	5600	10°	19.30
22300	26800	5800	8.5°	24.00

Actually, as is seen from Table I, the satellite does not stand still, so that the area visible becomes a strip rather than a circle. If the trajectory lies along the equator, the strip becomes a band extending on both sides of the equator. The heights needed to give a band width equal to each 10° of latitude are shown alongside the chart of Figure 6 (see next page).

There is an exception to the above process, which occurs for a height of 22,300 miles if the vehicle is on the equatorial line. Then the time for one revolution is 24 hours, or one day, and the vehicle therefore always remains directly over some particular point. For the case of the vehicle over the mouth of the Amazon river, the vision circle is the oval shown in Figure 6. This is actually a circle on the earth, but is deformed by the mapping system used.

It is not necessary that the trajectory lie along the equator; the only requirement is that the plane of the trajectory pass through the center of the earth. Of the infinite number of other combinations, those where the path passes over the poles appear the most interesting. For these, the paths of two successive revolutions around the earth do not fall together on the earth's surface, since the earth is constantly turning. This is shown by Figure 7 (see next page), which is computed for a vehicle altitude of 4,000 miles. It will be seen that in any 12-hour period the vehicle will have passed within viewing distance of every point

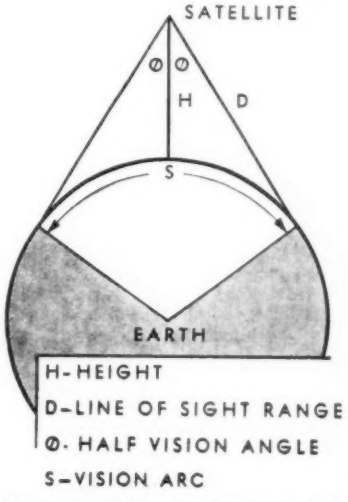

Figure 5. Sight range from a satellite.

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DALTON E-6B COMPUTER: Two sides. One with transparent erasable face for solving all vector problems—wind, true heading, groundspeed. Other side graduated for computing speed-time-distance, fuel consumption, air speed and altitude corrections, as well as statute-nautical mile conversions. Only $10, complete with carrying case and instructions.

DALTON MARK VII COMPUTER: Vector side "mocks-up" track-drift-true heading triangle, allows simple, easily-orientated setting-up and solution of all wind problems. Computer side for speed-time-distance, fuel consumption, air speed and altitude corrections, and statute-nautical mile conversions, plus erasable air speed calibration chart and flight log. Only $5 with instructions.

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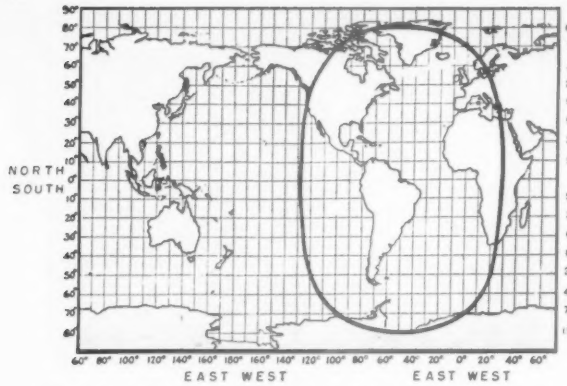

Figure 6. Area visible from equator depending upon altitude.

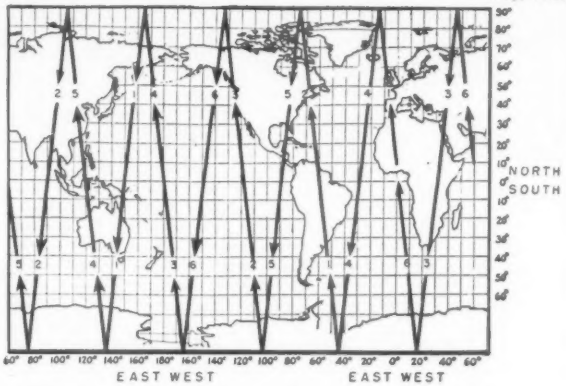

Figure 7. The earth turns beneath a vehicle at 4,000 miles.

on the surface of the earth.

The possibility of completely viewing the earth from the satellite vehicle immediately brings to mind a major application of the vehicle; that is, the preparation of a truly complete and accurate map of the earth's surface. The possibility of photography from extremely high altitudes has been adequately demonstrated in tests made at White Sands, N. M., using V-2 and *Aerobee* rockets. Note the photographs on page 19.

In this photograph the emphasis usually given is reversed to show the detail possible when the area covered is essentially directly below the camera, rather than along the horizon. Since, for a vehicle on a polar orbit, the vision width is always larger than the distance between successive paths, it will not be necessary to attempt to map to the horizon, and complete maps can be secured with good detail.

Note particularly the prominence of cloud coverage. This suggests that the satellite vehicle would be very useful in meteorology, if, for example, a televised image of the earth were transmitted to weather stations. Information as to cloud coverage would make it possible to observe the inception of a storm, to determine the position of warm and cold fronts, to observe their progress and, in conjunction with present data, to make more accurate predictions of future developments. The information made available should eventually make possible more accurate forecasts for a longer period than is now possible.

A third possible application of the vehicle, and the one which appears destined to become the major one, is its utilization as a radio relay station. It is well known that the use of very high frequency radio waves, such as are required for frequency modulation broadcasting, television, and cross-country relays are useful only if the transmitter is within line of sight distance from the receiving point, or essentially so. This severely restricts the coverage of these services.

The line of sight limitation is essentially removed if a relay transmitter is located in the satellite. For example, if the satellite is at an altitude of 22,300 miles, as in Figure 6, line of sight conditions would be satisfied for all of South America, North America except Alaska and a small part of Canada, half of Europe and two-thirds of Africa. An alternate system might utilize seven vehicles equally spaced about the equator at an altitude of 4,000 miles, so that one would always be within sight of any place on the earth lying within the limits of 60° North and 60° South latitude. This includes some 90 per cent of the earth's population.

The number of satellite relay stations needed for these coverages should be compared with the 60 or so earth surface stations which would be required to relay television signals from New York to Los Angeles, and the approximately 1,500 which would be needed to completely cover the United States.

It is, of course, true that these applications cannot be expected to materialize the instant the first satellite vehicle is successfully operated. There are many problems which must be solved, many experiments to undertake, and many concepts to revise. Nevertheless, the possibilities of the above and other applications to the modern way of life, and the future possibilities which are now merely dreams, show that useful applications of the satellite vehicle exist at any stage of its development, and that the program is a worthwhile task. END

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AND THERE I WAS . . .

MEDAL OF HONOR

The Transatlantic ATC run was rough that day, especially when the starboard engine started missing. The co-pilot passed through the plane reassuring the worried passengers. Throughout the excitement, however, one lusty old general sat calmly shuffling through some papers.

Somehow we managed to limp back to the mainland. As we embarked, the co-pilot remarked to the general:

"Sir, for a man in a land plane about to crash in the ocean, you were remarkably calm."

The general looked up in amazement. "Brave, hell!"— "I thought the damned plane was an amphibian!"

DONALD PUCKETT

Seaplane Comeback

(*Continued from page 29*)

cigar shape of the land plane hull. These tests employ a specially built and rigged Grumman *Widgeon* to which a variety of hulls can be bolted. The experimental hulls can be built, tested, interchanged, modified, and perfected with a minimum of time and expense. Preliminary tests indicate that their drag will not greatly exceed that of the land plane hull. Secondly, the seaplane is the perfect platform for the turbo-prop power plant. This hybrid engine, driving an improved propeller, produces superior power at very low weight. And what is most important, fuel consumption is excellent, even at low altitudes. The seaplane can save and convert the weight of wheels, landing gear structure, and a complicated hydraulic system (somewhere between 5 per cent and 10 per cent of the gross weight) into speed and range. Finally, the seaplane can operate from any of the 70 per cent of the earth's surface which is water, with no need for 18-inch concrete, 8,000-foot, obstruction-free runways.

As a clincher, take a look at the world map or globe. Fighting an intercontinental war requires that land planes have ranges of between 3,500 and 4,500 miles. Chicago to Berlin is 4,458 miles. New York to Moscow is 4,431 miles; Bombay to Warsaw is 3,579 miles. Building bigger bombers is not the answer at present. We've already mentioned that increasing the weight by 100,000 pounds only increases the range an approximate 300 miles, while serving to reduce top speed. The only other things that increase are the length of the runways, the thickness of concrete and the staggering expense of a base necessary to support such a Goliath.

All this talk about seaplanes isn't just dream material either. The planes are on the way. The first comer was the P5M which featured the long after-body hull. The X model of the P5M was described by the Navy as capable of "200 m.p.h. or more." Consolidated Vultee's P5Y should have even better performance. This elongated water bird will have four turbo-prop engines which will produce more horsepower at take-off per pound of airplane than most modern fighter aircraft. It also features an advanced design hull whose high length-beam ratio will give excellent water characteristics and reduced air drag. Translate these features—peak power and low drag—into performance and you have reached the goal, a *fast* seaplane.

Perhaps the most startling and unique innovation in the realm of seaplanes has been the British development of a *fighter*-seaplane, the Saunders-Roe SARO-1. This single-seater flying boat is unusual both in design and planned employment. It is the first *fighter type* flying boat, and it is the first seaplane to utilize the gas turbine. If the released performance figures of the first flights in July of 1948 are studied, it is apparent that the plane can hold its own in any pursuit plane's sky. The British will say no more than it is in the 500 m.p.h. class, that its rate of climb is better than 4,000 feet per minute, that it gets off the water in 11 seconds, and that its wing loading is under 40 lbs/ft. With drop tanks, the SARO-1 has a two hour range. Its wing tip floats are retractable, fairing into the wing by rotating through 180°. The plane has a 46-foot span, a 50-foot length and an ejection seat similar to the one used in our American jets. This one-seater jet seaplane is novel but practical evidence that the modern flying boat is not confined to a single purpose or mission.

From another angle, the seaplane looks to be the long sought aspirin for the submarine headache. To use the words of Secretary of the Navy Sullivan when he spoke before the House Appropriations Committee: "When World War II started, Hitler had fewer than 50 submarines and he very nearly won the Battle of the Atlantic. There is a nation which has, to our certain knowledge, more than 250 submarines today. I cite these figures merely to indicate to you the degree of our interest in the development of new submarines and new antisubmarine tactics." World War II proved that the airplane is the defense against the submarine, even one which can make 20 or more knots sub-surface. Our newer seaplanes will have the range, the endurance and the weight-carrying capacity to track down, hold down, and destroy the U-boat.

It is a reasonable conclusion that any advancements made by the military seaplane will be reflected in commercial fields. Indeed, with soaring production costs and the phenomenal financial outlays for design research, progress in commercial air must follow military air progress. Two world wars rushed air travel and transport out of its diapers and pushed it to full maturity. If the seaplane evolves into a fast, high flying, long reaching heavyweight, as all evidence seems to predict, it is inevitable that oceanic and intercontinental aviation commerce will become interested. A fundamental reason will be economy. Simplified design, simplified structure, elimination of landing gear and associated parts, fewer design restrictions (such as the ability to clear a 50-foot obstruction from a 5,000-foot runway) are all on the credit ledger. The airfield problem will diminish for these planes will operate in both shallow water and in all but the heaviest seas. Safety will increase. Forced landings at sea, take-off and landing accidents, will not take the toll of lives that comparable crashes on land exact.

Into the nascent seaplane versus landplane competition, another intangible is rearing its head. And that is the diminishing desire of the American public to fly faster. For the businessman and the merchant, speedier air transport will always be a prerequisite. But for the vacationist, the tourist, the traveller, saving an extra hour or half a day is not a necessity when comfort and ease can be substituted. The seaplane would appear to be the cheapest way of providing the air passenger with all the plush luxuries (bars, bunks, entertainment) of seagoing ocean liners.

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mark, has posed new problems. Like ships, these huge seaplanes will have to be drydocked. An experimental dock—portable and collapsible—was recently tested successfully at Port Hueneme, Calif. The dock was 103 feet long and was divided into eight sections which could be loaded aboard any small vessel. Hoisted off, piece by piece, the sections were then coupled together. Water was taken into the pontoon tanks to partially sink the dock, and the plane was then floated in; whereupon the dock was pumped free of the ballast water and the seaplane lifted into the air. This method obviated the time-consuming and tedious task of hoisting the planes onto a tender for overhaul and repair. The commercial uses of such a dock are obvious.

The seaplane has one other trait which makes its return engagement on the military scene even more promising—versatility. The seaplane has more uses than an alley cat has fleas. The number of its utilitarian roles is exceeded only by the helicopter. The seaplane is a natural for rescue duty and aerial weather reconnaissance; it is an ideal photographic platform; as a transport, both personnel and material, it is unsurpassed. For reconnaissance, for communication and radar relay, for convoy coverage, for coastal and harbor protection, the seaplane cannot be equalled by aircraft of any other type.

If one listens to those interested in the seaplane's future, he hears some ideas which, if not downright startling, are at least Buck Rogerish. Some of the designers are calling the futuramic seaplane the "flying freight train" and predict it will supplant the ocean-going transport. Others are saying that any future amphibious assaults will be sparked by troops landed suddenly and silently from mammoth seaplanes. And still others are designing parasite fighters (similar to the XF-85 hook-on arrangement to the mother B-36) to protect the nest and the cargo once it has been put ashore in enemy territory.

Seaplanes and the art of building, flying and using them, have long been an American monopoly. In these days of the Cold War and repeated international crises, the seaplane is coming back to be our ace in the hole. END

Air Line Skies

(*Continued from page* 15)

back their help. The water carriers have never earned back theirs.

So what was all the uproar about in 1947, when the then Chairman of the CAB (who was afterward retired) was making speeches about airline bad management and over-expansion, and Congress and the newspapers and the public were drinking it in?

Today one wonders, and history will always wonder. The cost of doing business increased nearly ⅔ pre-war to post-war, which economists concede more than offset the unit savings to be expected from increased volume. Consequently one would have supposed the airlines in the three years since the war would have been entitled to at least the same mail rate they were paid in 1941. *Had they been paid that mail rate they would have had a profit of $61,000,000 for those three years instead of a loss of $37,000,000. What is more important, had they been paid a rate proportionate to the vast increase in service performed in other categories beside the carriage of mail they would have had a profit of $185,000,000.*

Take a simple comparison. Suppose you are in the habit of buying one quart of milk each morning for 22 cents. Now suppose you decide you want five quarts and, although the rest of your cost of living has gone up 62 per cent, your dairy charges you only 57 cents for the five. Would you feel you were being cheated? I judge not. You are getting five times the milk for only 2½ times the total cost, in spite of the rise in the price level. Yet this would be precisely the situation between the airlines and the taxpayer *if the airlines were now paid a mail rate sufficient to return them 10 per cent on their investment for every year since the war!*

Does this sound as if mail pay might have something to do with the airline problem, or do we have to search elsewhere? The question is rhetorical, but one becomes more and more startled as one considers the sort of thinking that has marked criticism of the airlines until recently. Instead of accepting the obvious, responsible public officials have preferred to lay the blame on almost everything else, but especially on over-expansion and low load factors. These in turn, of course, have been attributed to bad management.

Let us again look at the facts. Since 1941 the number of route miles in the airline network have been multiplied by less than three. At the same time, the number of passenger miles have been multiplied by nearly five. In other words, the density of the system has been almost double. How can anyone in his right mind regard this as "over-expansion" or consider it as contributing in any degree to air line losses? Because certain isolated segments may be saturated is no reason for confusing them with the main problem. A man with a severed artery may incidentally have a headache but you don't treat the headache, you mend the artery.

Or take the related matter of load factors (the percentage of available seats actually occupied). The average Pullman load factor for the six years preceding the war was 41 per cent. For the year 1947 it was 54 per cent, and no year, other than the war years, has equalled 1947 on the rails. There are no figures for coach travel but it is certain they would be lower than Pullman. Bus figures tell the same story. Load factors above the fifties simply are not a part of the economics of transportation in peace time. Public convenience would suffer if they were.

Now look at the airline situation: load factor for last peacetime year (1941), 59 per cent; for 1947, 66 per cent; for 1948, 59 per cent estimated. Where is the over-expansion there? Momentary episodes of over-buying and over-staffing, yes. But as to these episodes having any real significance in the total financial picture, obviously no. One might as well place on the Washington monument the blame for the tides. The basic cause, the only significant cause, of our depressed air transport industry has been mail rate deprivation and we might as well—all of us—face it.

And why shouldn't we? The airlines have excelled every other form of transportation in the past in the matter of subsidy—have done more for less, have earned back their help faster! They will do so again if proper clearance is received.

The happy part of it is that the CAB, and I think the Congress, show signs of granting it. The only kind of action that can solve the problem is being taken. Mail rates are being increased, rapidly and substantially. Key senators are making encouraging statements. The CAB and the Congress, being human, will wrap up the mail pay in careful reservations, will talk much of reciprocal obligations, will continue to murmur mergers—and no doubt consummate a few. Many people, inside and outside Government, have got to save face—let us not begrudge them the gesture.

Moreover, adversity, however undeserved, has taught the industry much. From the pocketbook standpoint the taxpayer will probably be still better off in the end, and from the development and service standpoint the lost ground of the past three years will be regained in time. Such is the silver lining to the cold front clouds still visible around and behind us, but breaking ahead. END

Windmill

(*Continued from page 35*)

longer requires huge friction forces to prevent severe feed back, nor does the pilot have to be cautious of how fast or in which direction he moves the controls, in order to prevent cycling."

Hiller is the aircraft industry's youngest manufacturer. When he was only 15 years old, he began designing and building a productionable, stable helicopter.

In 1944, when he was 19, he test flew his Model XH-44, the world's first successfully flown co-axial helicopter. This model is now in the Smithsonian Institution.

SPECIFICATIONS and PERFORMANCE
HILLER 360

WEIGHTS	
Maximum certified gross weight	2,247 lbs.
Empty weight	1,447 lbs.
Useful load	800 lbs.
FUSELAGE	
Construction	all-metal, semi-monocoque
Maximum fuselage width	59 in.
Length (tail rotor vertical)	320 in.
Height (to top of rotor)	114 in.
CABIN DIMENSIONS	
Width (at seat)	63⅜ in.
Length (seat back to nose)	53½ in.
MAIN ROTOR	
Diameter	35 ft.
Number of blades	2
PERFORMANCE	
Top speed	84 m.p.h.
Cruising speed (70 per cent power)	75 m.p.h.
Range	200 miles
Endurance	2.5 hrs.
Vertical rate of climb	400 f.p.m.
Maximum rate of climb	900 f.p.m.
Service ceiling	over 10,000 ft.
Maximum vertical take-off altitude (no wind)	6,000 ft.

He worked on development of a large co-axial rotor system and small electronic signal device for the Navy during the war.

In 1945, he formed United Helicopters to continue research toward his original goal of producing helicopters commercially. For his success in engineering and manufacturing a number of *Commuter* helicopters, a streamlined, two-passenger co-axial craft, he took first prize at the World Inventors' Congress in Los Angeles in 1947.

While building the *Commuter*, Hiller hit upon the idea of the simplified direct control rotor system. Late in 1946, following test stand proving of the system, he worked out and incorporated the overhead control stick connection through a simple linkage to a servo-control rotor.

After many successful flights and hundreds of hours of air time on a small one-passenger test frame, the control rotor was designed into the Hiller 360, the pilot production model of which flew for the first time in the fall of 1947.

The basic structure of the 360 was designed to meet varied requirements of agricultural, industrial and commercial helicopter operations.

Hiller says equipment for crop-dusting, air-mail, cargo, photographic or survey operations can be easily installed on the basic flying structure without affecting performance or flight characteristics.

If "plush" models are desired, there is a convertible canopy which can be fastened over the cockpit in a matter of minutes. There also is a "dress up" aluminum canopy to fit over the engine for the more fastidious customers. The 360's price is $19,950 f.a.f.—by far the lowest priced 'copter on the market. END

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Lights

(*Continued from page 42*)

lights on and off. The lights need not be run all night, but used as desired.

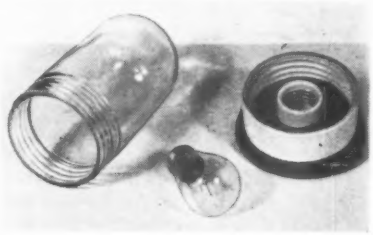
Use a standard installation to run the two single-conductor wires to the runway and the switch box. And simply lay the 18-gauge two-conductor wire on top of the ground along the edge of the landing strip. If there is to be traffic across any portion of the strip that section of the wire can be buried to protect it. Caution should be used to see that there are no splices in the line to be buried. It should be covered with enough dirt to insure protection when the ground is soft and rutting might expose it. Some persons place a board over the wire, then cover both with dirt. This insures protection and assists in finding the wire should it become necessary to dig it up for repairs.

Special attention should be given to splices, which must be moisture proof. The wires may be only twisted together but soldering is recommended. The splice should first be wrapped with black friction tape, then wrap entire splice area with rubber tape. Cover the rubber tape with another layer of friction tape. Be sure to tie the end of this tape since weathering will cause the tape to dry and come loose. Finally, give the splice a thorough coat of shellac or clear dope to complete the weatherproofing. One set with which I am familiar has been on the ground for nearly three years and the splices made as described are still in good condition. Cattle have grazed over the wire with no damage. Eventually, grass grows around the wire so that it lies close to the ground and is thus well protected from snagging.

Lights should not be spaced over 300 feet apart. They need not be placed closer together than 150 feet unless the profile of the landing strip is acutely variable. The lights should outline a strip at least 75 feet wide. When landings are known to be predominately in one direction, it is wise to install lights closer together on the pilot's side of the landing plane. Lights on the "off-side" of the plane may be 300 to 400 feet apart. If such is the case, it is more economical to lay the wire only on one side of the runway and splice in 75-foot lateral buried wires to run across the runway to the "off-side" of the strip.

Commercial fixtures like the above will give top efficiency from a 10-watt bulb.

Try to keep the total number of bulbs low. It is not only more economical but there will be less voltage drop on the "far end" of the runway and consequently the end lights will be brighter. Too much concern should not be felt here though, for one 3,000-foot string has 15 lights on it, some of them 25-watt, and there is no noticeable difference in the end light intensity. This set pulls about 250 watts of current and the owner estimates it costs less than 25 cents per night to burn. Even though the wattage is low, these 10-watt lights have been seen for over 10 miles on haze free nights.



A fruit jar and ordinary light fixture can be used for inexpensive installation.

Should colored bulbs be used for any reason, they should be of higher wattage since the globe coloring cuts the intensity. Twenty-five or 40-watt bulbs seem to be adequate. Centered green lights are used to mark the end of each runway. If the strips are long, the green may not be prominently visible. Two clear bulbs can be installed on either side of the green lights and the closely spaced white lights will help to show the green light location. Red lights should be mounted on major obstructions in the landing and take-off areas. For those who prefer, or for difficult obstruction lighting problems, one commercial lighting manufacturer has a reasonably-priced approach light. In buying colored bulbs, the old type outside frosted bulbs should be chosen over the inside glazed colored ones, since they are visible from a greater distance.

Experience has shown that such a lighting set is inexpensive to install and operate, and with reasonable care the lights are as dependable as the lights in your living room. END

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4304	Aeronca Champion 1946-48	$49.00
4305	Aeronca L3 1943-44	51.70
4330	Cub J3 1940-47	37.00
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4355	Luscombe 1940-48	49.00
4369	Skyranger	57.00
4362	Stinson Station Wagon 1946-48, per set	72.00
4364	Stinson L5	57.00
4381	Taylorcraft L2	49.00
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The Mail Box

(*Continued from page 6*)

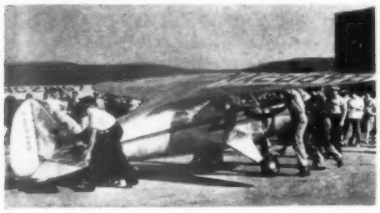
problem. It deals with a plane that stalls at 70 knots, gliding at the rate of 80 knots into a 40 knot headwind when the headwind suddenly stops completely. Hy says the ship will positively stall, the actual airspeed will drop and the indicated airspeed will also show a 40 knot drop.

"About this time, no doubt, Mr. Sheridan is receiving letters by the bale pointing out that he is off his trolley on this one; and that, once in flight, wind means nothing to the airplane as far as lift is concerned. We are glad to report that, using our contest letters as a criterion, most . . . Sealand pilots have a better understanding of things than that. Hy is absolutely right *including* his state-

ment about the airspeed indicator showing a 40 knot drop. . ."—ED.

THE NAUGLE MERCURY

I understand that Richard G. Naugle ["Will Missiles Replace Fighters?", January FLYING] designed and built the remarkable, high-performance lightplane, the Naugle *Mercury*.



A promising design.

. . . Why did such a promising design disappear from the personal aviation scene?

JACK W. TAYLOR

Huntingdon, Pa.

● R. G. Naugle says: "The all-metal, cantilever, high-wing *Mercury* monoplane, built by the Naugle Aircraft Corp. in 1940 at Latrobe, Pa., was sponsored by a group of Pittsburghers.

"It was designed as a high performance two-place lightplane, powered with the geared Lycoming 75-h.p. engine and weighed about 1,200 lbs. fully loaded. Flaps and fixed slots were incorporated. Mareng fuel cells, the first to be used in a small plane, were located in the wing structure, and the rubberfoam seats were probably another first for small planes.

"When the war came, the project was postponed. The *Mercury* will probably never be built, simply because far better designs are now available.

"The *Mercury*, however, showed what clean design can do. With a top speed of 141 m.p.h. (with a 75 h.p. engine) and a flaps-down landing speed of about 46 m.p.h., it could have provided plenty of competition in the post-war market." •

WHERE IS THAT JOB?

. . . I have four years of engine aircraft experience, a private license, two years of college, and two years of business experience. But I am astounded by your article "Your Job in Aviation" [January FLYING]. For 12 months I sent dollar bills and money orders to every aircraft employment agency [I could locate]. Then I moved to Wichita, Kan., the heart of the aircraft industry—no job. Went to Tulsa, Oklahoma City, Dallas, and Fort Worth. I've filled out more applications than there ever will be jobs for A&E's. I've contacted American Airlines, Braniff, Chance-Vought, Temco, Beech, Cessna, Boeing, Bell, and Martin. Friends have told me American and TWA are laying mechanics off.

So I read in FLYING that the surplus of mechanics will soon be exhausted!

KEN STRAYER

Wichita, Kan.

● Author Herman B. Byer of the U. S. Bureau of Labor Statistics pointed out in the FLYING article that a present surplus of mechanics exists. But he said "hiring will soon become heavy enough to diminish greatly—possibly even to wipe out—the present surplus . . ." Since the article was prepared, employment of production workers in aircraft and parts and aircraft engine establishments has risen by about 25,000.—ED.

THE NAVY

. . . Let's have less Navy propaganda against the Air Force. A good example was John Stuart's article ["Case for the Air Navy," February FLYING]. We get enough hoopla from the battleship admirals in the newspapers without having them use a good aviation magazine like FLYING.

FLYING is still the best aviation magazine in the country. Keep it that way, with less [military articles such as] Colonel Hotrock's Theory of Aerial Gunnery at 60,000 feet and more about Grandpa Gus and his Aeronca.

DEANE R. BRANDON

San Francisco, Calif.

. . . the article is one from the button-shoe days. . .

BEN L. BROWN

Cincinnati, Ohio

(1) [The Navy] may be able to shoot down aircraft at speeds up to 600 m.p.h. but, brother, to state flatly, "bring on the guided missiles" is too much. They won't be shooting at *Jennies*. They'll be shooting at something moving 1,000 m.p.h. or better.

(2) One B-36, dropping two well-placed atomic bombs, could render a whole carrier task force useless by wiping out the four carriers and four escorting ships. . . Check it yourself with a pair of dividers, using the diagram accompanying the article. And if the ships cruise farther apart, they'll be open to attack by snorkel submarines, of which Russia is reportedly laying in a huge supply.

The Navy has a place in our defense. But leave us not spend a major share of the budget on a minor partner.

C. E. PORTER

Juneau, Alaska

NOW DOWN IN TEXAS . . .

[In regard] to the picture of Miss Skelton [February, FLYING] snaring a rope from two poles 10 feet high and 15 feet apart—hah!

Here in Texas we have a pilot, flying a standard *Cub*, at better than 75 m.p.h., who picks up a small handkerchief hanging between two sticks two feet apart and ten inches from the ground.

Skelton isn't so hot after all . . .

FRED MICHNA

Refugio, Tex.

ONE STOP

. . . My heartiest congratulations to FLYING for such a complete "one-stop" reading magazine.

L. L. MCCHAREN, M.D.

West Point, Miss.

FLYING DOWN BELOW

. . . Aviation here in Australia is a small game, but we're progressing. Thought you might like to have some details:

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DM-25: 12v, 2.3A. in; 250v, .050A. out..... 2.49
DM-28R: 28v, 1.25 in; 275v, .070A. out..... 8.95
DM-33A: 28v, 7A. in; 540v, .250A. out..... 5.50
PE-86: 28v, 1.25 in; 250v, .060A. out..... 3.95
23350: 27v, 1.75A. in; 285v, .075A. out..... 3.80
5053: 28v, 1.4A. in; 250v, .060A. out..... 3.95
DA-7A: 26.5v, in; 1100v, .400A. out..... 25.00

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PE-218: 25v, 92A. in; 115v, 400cy, 1500VA. out.....$49.95
PE-206: 28v, 38A. in; 80v, 800cy, 500VA. out 12.50
GE-5D21NJ3A: 28v, 35A. in; 115v, 400cy, 485VA. out 49.95

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LOOK AT THE FIGURES

["Efficiency Race," January, FLYING] was very . . . interesting [but] I would like to comment on your statement "Arner's winning plane actually averaged only 3.8 gallons per hour which was less than any other plane . . . except D. Pinelli's winning Luscombe *Silvaire* . . . and Margaret Harrison's *Ercoupe* which burned 3.6."

Let's look at the figures:

	Gasoline Consumed	Gal. Hr.	Mi. Gal.	M.P.H.
Arner's *Bonanza*	7.25	3.8	30.0	114.7
Pinelli's *Silvaire*	8.8	3.5	24.8	85.6
Harrison's *Ercoupe*	10.2	3.6	21.4	76.5

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HOW OLD?

. . . I recently read in the papers that a 16-year-old boy was flying a *Cub*. How old do you have to be in order to get a pilot's license?

JOHN A. FLEMING

Jackson, Miss.

● To solo, flyers must be 16; to obtain a private license, 17; to qualify for a commercial license, 18.—ED.

Supersonics

(*Continued from page 18*)

ing a vee-shaped partition in a hallway. The jamming up on each side of the partition as the crowd seeks to go through the smaller space is exactly what happens with supersonic flow. Unable to get out of its own way, it forms an oblique shock wave. Any shock wave means simply that fast-moving air has been slowed down suddenly and compressed, like the shock wave of an explosion.

The shock wave, technically defined, is a region of compression through which air flows in making a change in speed or direction. The backward angle of this wave is determined by the speed of the air and the shape of the object. Visible when sunlight strikes it at the proper angle to the pilot's line of vision from the cockpit, this shock wave looks very much like a heat wave rising from a hot pavement.

As this supersonic flow reaches the corner on the wedged-shaped airfoil, it acts like the crowd pouring suddenly out of the corridor into a large open space. Speeding up, and spreading out, the density is decreased. At zero degrees angle of attack, another shock wave forms at the trailing edge as the flow of air from above the wing meets that from below, both being deflected. Here are revealed two very important characteristics of supersonic flow. When the flow is altered at an acute angle, as into a corner, it is always slowed up and forms an oblique shock wave but, in rounding a corner, changing direction at an obstuse angle, it expands and accelerates.

Can a typical round-edged subsonic airfoil be flown beyond the speed of sound? Yes, but at a much greater expenditure of power for the same thickness of airfoil. The round edge of the airfoil causes a piling up of the air in front of the wing, whereas, on the knife-edged supersonic section the air is not affected until it reaches the wing, then slants off cleanly from the leading edge as oblique shock waves. Most interesting is the fact that the bow-shaped wave will never attach itself to the round-edged subsonic wing, no matter how fast the plane flies, but the oblique wave of the supersonic section attaches itself to the wing and sweeps cleanly back. The result of pushing a subsonic wing past the

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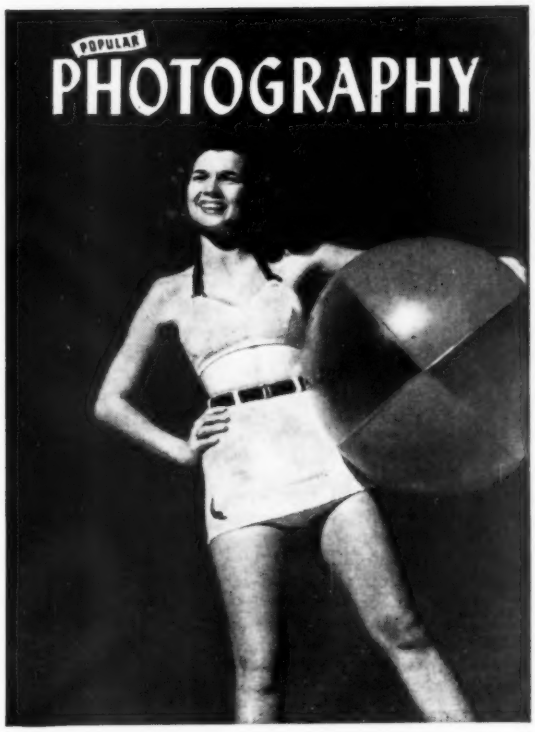

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speed of sound is like plowing snow with a straight board, rather than with a veeplow, and the power required is correspondingly enormous.

It is the formation of this type of shock wave that causes the vast increase in drag and power required, buffeting, and even loss of control, when a plane designed for subsonic speeds approaches the speed of sound. It may be that the flow of air over the wing, traveling a greater distance between leading and trailing edge than does the flow beneath the wing, is stretched out and accelerated beyond the speed of sound. While this may be accomplished smoothly enough, the sudden transition as the fast-flowing air slows down near the trailing edge creates another shock wave close to the rear edge of the wing.

All normal conditions are upset. Ailerons wallow helplessly in the turbulent air. The shock wave itself hinders the normal flow of air past the machine, vastly increasing drag. The normal down flow of air from the wing may disappear and in its place a maelstrom of turbulent air bubbles flow straight back over the tail surfaces, robbing them of their stabilizing effect and control. Lift may be destroyed. To compound the evils, a shock wave may form beneath the wing at a different location chordwise from the one atop the wing, adding another source of instability which, combined with the loss of lift, perhaps ends in a fatal dive to earth. Taking place in chaotic sequence, these conditions multiply and even reverse stick forces, to the undoing of the cleverest pilot alive.

Designers have solved this many-faceted nightmare. They created a wing that controls the formation of shock waves to permit the development of lift. In this type of wing, the shifts in compressible supersonic flow are the same above and below the wing, thus maintaining balance. And they have located the tail surfaces out of the wing's turbulent wake. This explains the configuration of planes like the Bell X-1 and the Douglas *Skystreak*.

The speed at which the velocity of sound is reached by the plane or wing is its critical speed, or critical Mach number. Every subsonic airplane is so limited and it is the control problem which actually sets the limit at which the ship can fly, even though it may have power to fly faster. Record-breaking speedsters usually are permitted to fly only as fast as the engineers consider safe. This, then, is the true nature of the sonic "barrier."

If controls could be designed purely for subsonic or supersonic flight, there would be no overwhelming problem. Unfortunately, the mixed air flow causes trouble all the way from Mach about 0.8 to about Mach 1.2, or from 8/10ths to 12/10ths the speed of sound. The answer, admit the scientists sadly, is unknown.

One widely circulated tale that should be scotched is the story that, beyond the speed of sound, drag and power required fall off mysteriously. This is not so. What does happen is that the *rate of increase* of power required as the speed of sound is approached, does fall off, but that the actual power required continues to rise. Power required for supersonic flight increases as the cube of the speed, whereas for subsonic flight the increase is only as the square of the speed. To increase speed from 1,000 to 2,000 m.p.h. requires an eight-fold power increase. If, say, 10,000 h.p. were needed for 1,000 m.p.h., 80,000 h.p. would be required for 2,000 m.p.h.

Even so, no fantastic powerplants of now-impossible power will be needed for the 1,500 m.p.h. airplane. What we lose sight of is the enormous increase in power of the jet and rocket with higher speeds. While it is true that one pound of thrust does equal one horsepower at about 375 m.p.h., that thrust figure soars up, and up, as speeds climb. The familiar jet may put out 150,000 h.p. above 1,500 m.p.h., and some forms of jet may come closer to 200,000 h.p. at 2,000 m.p.h. The problem is more the plane than it is the power. At 1,500 m.p.h. drag is almost beyond comprehension, balancing even the 150,000 of the jet! END

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ASTRO compasses (New surplus) $12.50; Model "G" New Computer $7.50; Fairchild (surplus) Sextant $12.50; Aerial Camera F8 (Navy surplus) $139.00; New Taylor Barometer (Brass) $18.00; New D-12 Magnetic Compass, $150.00 value, only $12.95; New improved E-6B Computer $10.00; Weems Navigation Plotter $2.00; AAF-type A-2 Computer $2.00; American Airlines Computer $5.00; Weems Second Setting wrist watch $43.75; (Free Catalog): Pan-American Navigation Service, 12021-8 Ventura Blvd., N. Hollywood, Calif.

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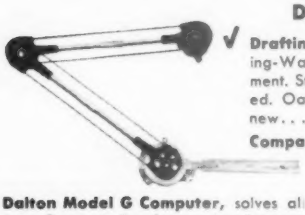

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